SAMPLING AND ANALYSIS PLAN (SAP)
PHASE II ENVIRONMENTAL SITE ASSESSMENT
USEPA BROWNFIELDS ASSESSMENT GRANT NO. 96345801

MACHINE SHOP PROPERTY
WEIRTON, HANCOCK COUNTY, WEST VIRGINIA

Prepared For:

BUSINESS DEVELOPMENT CORPORATION
OF THE NORTHERN PANHANDLE

Prepared By:

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EXPORT, PENNSYLVANIA

CEC Project 164-123

April 19, 2017

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Phase II Environmental Site Assessment
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TABLE OF CONTENTS

This Site-Specific Sampling and Analysis Plan for the Machine Shop Property in Weirton, West Virginia is a companion document to the general Quality Assurance Project Plan for the Business Development Corporation of the Northern Panhandle (BDC). All of the policies and procedures specified in the Quality Assurance Project Plan will be followed for this project.

PROJECT MANAGEMENT

A1 SITE INFORMATION/BACKGROUND

Civil & Environmental Consultants, Inc. (CEC) was retained by the Business Development Corporation of the Northern Panhandle (BDC) to perform a Phase I Environmental Site Assessment (ESA) of the Machine Shop Property (Site) located on Main Street and State Route 2 in Weirton, Hancock County, West Virginia. The Phase I ESA was completed under U.S. Environmental Protection Agency (USEPA) Brownfields Assessment Grant No. BF 96345801 and submitted to the USEPA on February 28, 2017. The Phase I ESA report identified seven Recognized Environmental Conditions (RECs) at the Site. Four of these have been investigated under the RCRA Corrective Action program implemented by the previous owner. The Phase I ESA report recommended that a Phase II ESA be performed on the remaining three. In addition to the identified RECs at the Site, onsite structures planned for demolition were discovered to have the potential presence of asbestos containing materials (ACM). Removing ACM prior to demolishing structures is required by West Virginia law. Therefore, it has been recommended to perform ACM surveys, including the sampling and analysis of suspect ACM on these structures. This Sampling and Analysis Plan (SAP) provides a scope and schedule for these Phase II activities and is a supplement to the Quality Assurance Project Plan (QAPP) that has been approved by USEPA.

The Site is situated between Main Street and State Route 2 in Weirton, Hancock County, West Virginia. The approximate Site location is presented on Figure 1, and a general Site layout is presented on Figure 2. The Site encompasses approximately 9.3 acres and is comprised of several non-contiguous individual tax parcels located between Avenue D and the intersection of State Route 2 and Main Street. The Site was historically owned by the Weirton Steel Corporation and subsequent owners (i.e., ISG Weirton, which eventually became ArcelorMittal Weirton LLC) as part of much larger land holdings that comprised a steel manufacturing facility and supporting operations. Specific operations at the Site included a Central Machine Shop where steel-making components were fabricated/repaired and a Trucking Department where facility vehicles were fueled/serviced/dispatched. The Machine Shop and Trucking Department Operations were shut down after 2011, and these portions of the Site have remained vacant since that time. On January 31, 2017, Mingo Junction Steel Works, LLC (MJSW) purchased approximately 1,300 acres from ArcelorMittal, including the Site. The BDC purchased the property from MJSW in early March 2017. The BDC will lease the property to Bidell Gas Compression (Bidell), a subsidiary of the Canadian company Total Energy Services, Inc., who will repurpose the Machine Shop building for the fabrication, sale, lease, and service of natural gas compression equipment. The Site is located in an area of industrial, commercial, and residential use.

The three RECs recommended for Phase II assessment include the following:

- One transformer was observed outside the northeast wall of the Machine Shop. Oil stains were apparent around the base of the transformer pad (approximately 7 x 7 feet) and fresh slag had been placed around the surrounding area. No stickers indicating polychlorinated biphenyls (PCB) content were observed on the transformer;

- Oil staining was observed along the outside northern and eastern walls of the compressor shed located along the outside northeastern wall of the Machine Shop. A full waste oil tank (approximately 200 gallons) is also located along the outside wall of the compressor shed; and
- Soil staining and residues (dark soot-like and white crystalline) were observed inside the hoist shed in the Trucking Department.

Pending the results of the Phase II ESA, surface soil appears to be the only environmental media impacted by the above RECs.

A2 PROJECT DESCRIPTION

Visibly impacted surface soil associated with the RECs described in Section A1 will be excavated to a depth of approximately 12 inches or until visible impacts have been removed. The Phase II ESA will include the collection and analysis of soil samples from the base of the excavated areas to demonstrate impacted soil has been removed. The soil analytical results will be compared to applicable West Virginia Industrial Soil De Minimis Values in accordance with Appendix A, Table 1, and Table 2 to assess the need for further action.

The Phase II ESA will also include the sampling and analysis of suspect ACM to evaluate potential abatement requirements prior to demolition of the following structures located in the former Trucking Department area: the shed located along Route 2, the office/locker room building, the hoist shed, aboveground piping along the southeastern boundary of the property, and the maintenance building.

A detailed description of these sampling programs is presented in Section B1.

Summary of Data Quality Objective Process

Decisions to be Made

Bidell, who is repurposing the Machine Shop, needs unrestricted access to all areas of the Site. Having unlimited access will depend on the results of the soil removal and subsequent sampling. If analytical results indicate that concentrations of constituents of concern (COCs) exist in excess of the corresponding West Virginia Industrial Soil De Minimis Values, additional excavation and sampling will be required.

The results of the ACM sampling will determine whether abatement is required prior to demolition of the Trucking Department structures.

Information Required to Make Informed, Defensible Decisions

Information required by the BDC is the focus of this Phase II ESA and includes soil analytical results, screening of the analytical results against the applicable West Virginia Industrial Soil De Minimis Values, and an estimate of the cost of any further action that may be required.

Additional information required includes the location, identification, and quantity of ACM in order to implement proper abatement procedures prior to and/or concurrent with demolition activities.

Constraints on the Investigation

The surface soil confirmatory sampling program is limited to the area around the RECs to be investigated as part of the Phase II ESA. The location of these RECs are shown on Figure 2. The budget estimate for performing the investigation activities described in this SAP is $11,000.

The ACM surveys are limited to the following structures: the shed located along Route 2, the office/locker room building, the hoist shed, aboveground piping along the southeastern boundary of the property, and the Trucking Department maintenance building. The budget estimate for performing the investigation activities described in this SAP is $5,000.

Decision Matrix

If the surface soil analytical results show that constituent concentrations are below the applicable West Virginia Industrial Soil De Minimis Values, the excavation areas will be backfilled with clean fill and graded, and Bidell will have unrestricted use of the Site. If the soil analytical results show that constituent concentrations are above the applicable West Virginia Industrial Soil De Minimis Values, additional excavation will be required.

If the sampling and analysis indicate that ACM is present, the BDC will proceed with asbestos abatement prior to demolition activities.

Uncertainty

The soil confirmatory sampling program design, including the selection of sample locations and analytical parameters, has been developed to confirm that surface soil impacts associated with the RECs described in Section A1 have been addressed. It is understood that uncertainty cannot be eliminated, particularly in identifying localized areas of contamination within the Site.

The soil data will be reviewed to identify whether any significant data gaps remain with regard to the extent of contamination or potential contaminant exposure pathways. If necessary, additional sampling will be recommended to fill significant data gaps.

The ACM survey design, including the identification and analysis of suspect ACM, has been developed to identify the location and quantity of ACM at the Site. It is understood that uncertainty cannot be eliminated, particularly in identifying potential ACM within limited access portions of the structures.

The data from the ACM surveys will be reviewed to identify whether any significant data gaps remain with regard to the presence of ACM. If necessary, additional sampling and analysis will be recommended to fill significant data gaps and adjust the scope of abatement activities concurrent with demolition activities.

A3 PROJECT TIME LINE

The progress will be tracked from its inception through implementation to document all sampling and analytical activities are performed in a correct and cost-effective manner. Each step in this process will be scheduled in an objective and realistic timeframe to assure adequate attention is devoted to the minimization of effort and the maximization of information. Table 1A provides a project timeline for the surface soil confirmatory sampling program. Table 1B provides a project time line for ACM surveys for the onsite structures with planned demolition.

A4 MEASUREMENT QUALITY INDICATORS

To assess if environmental monitoring measurements are of an appropriate quality, the general PARCC (Precision, Accuracy, Representativeness, Completeness, and Comparability) requirements detailed in Sections 1.3 and 4.3 of the QAPP and the site-specific Measurement Quality Indicators (MQIs) for precision, accuracy, and completeness will be compared to the site-specific quality objectives and measurement performance criteria. Table 2 provide the MQIs for representative potential constituents of concern based on the results of the Phase I ESA. This table provides information regarding the precision, accuracy, and completeness of the laboratory analyses for these constituents, as well as the applicable West Virginia Industrial Soil De Minimis Values that will be used for comparison with the analytical results. Table 2 also provides associated method detection limits (MDLs) and reporting limits (RLs) for each constituent.

Information related to MQIs for the ACM survey is included in Appendix B.

MEASUREMENT/DATA ACQUISITION

B1 SAMPLING DESIGN

Visibly impacted surface soil associated with the RECs described in Section A1 will be excavated to a depth of approximately 12 inches or until visible impacts have been removed. The approximate extent of excavation is shown on Figures 3, 4 and 5. The excavated soil will be disposed offsite in accordance with applicable laws and regulations.

Surface Soil Confirmatory Sampling

The soil confirmatory sampling program was designed to demonstrate that impacted soil has been removed. A summary of the soil confirmatory sampling program is as follows:

- Transformer: Following excavation, three (3) soil samples will be collected at the base of the excavation (evenly spaced within the excavation area) and analyzed for PCBs to demonstrate that impacted soil has been removed;

- Compressor Shed: Following excavation, three (3) soil samples will be collected at the base of the excavation (evenly spaced within the excavation area) and analyzed for Target Compound List (TCL) Volatile Organic Compounds (VOCs), TCL Semi-volatile Organic Compounds (SVOCs), Target Analyte List (TAL) metals, and PCBs to demonstrate that impacted soil has been removed; and

- Hoist Shed: Following excavation, two (2) surface soil samples will be collected at the base of the excavation (evenly spaced within the excavation area) and analyzed for TCL VOCs, TCL SVOCs, and TAL metals to demonstrate that impacted soil has been removed.

The approximate locations of each soil sample are shown on Figures 3, 4, and 5. Table 3 provides the types and number of samples and analyses required for this project. Appendix C contains the site-specific Health and Safety Plan (HASP) for completing the work.

ACM Survey

The ACM survey, including the sampling and analysis of suspect ACM, was designed to evaluate potential abatement requirements prior to demolition of the following structures in the former Trucking Department area: the shed located along Route 2, the office/locker room building, the hoist shed, aboveground piping along the southeastern boundary of the property, and the maintenance building. A summary of the proposed ACM survey, which will be completed by Mid-Atlantic Environmental Consultants in accordance with the QAPP, is as follows:

- Identify suspect ACM including the material type, location, and approximate quantities;
- Collect and analyze samples of suspect ACM with sufficient frequency to develop a corresponding abatement plan for demolition purposes. Sample locations and sampling

frequency will be determined in accordance with 40 CFR 763.85 and 763.86 and Mid-Atlantic's Guidelines for an Asbestos Survey (Appendix D); and

- Prepare a report of findings to include detailed maps with the location and extent of ACM and corresponding samples.

Appendix D contains specific guidelines for completing an asbestos survey in accordance with the USEPA approved QAPP. Appendix C contains the site-specific HASP for completing the ACM survey.

B2 SAMPLING METHODS REQUIREMENTS

All soil samples will be collected and analyzed in accordance with procedures found in the QAPP. For convenience, laboratory analytical procedures for the surface soil samples are found in Appendix A. Table 3 provides general information about the surface soil sampling techniques that will be used for this project. For specific details about the sampling procedures referenced in Table 3, refer to the Standard Operating Procedures (SOPs) attached as Appendix E and to the appropriate sections of the QAPP. All soil samples will be collected and preserved in accordance with procedures found in Table 1 of the QAPP. Field Quality Control Requirements for soil sampling activity are found in Table 2 of the QAPP.

All ACM samples will be collected and analyzed in accordance with procedures found in the QAPP. For convenience, laboratory procedures are included in Appendix B and field procedures are included in Appendix D.

B3 ANALYTICAL METHODS REQUIREMENTS

Soil Sample Analysis

Table 3 provides information about the analytical methods (including any extraction or digestion methods) being used for this project. Additional information about analytical methods requirements (MDL, PQL, etc.), laboratory quality control requirements, and laboratory equipment calibration procedures can be found in Appendix A.

ACM Analysis

Samples of suspect ACM will be analyzed by polarized light microscopy (PLM). Additional information about analytical procedures, laboratory quality control requirements, and laboratory equipment calibration procedures can be found in Appendix B.

DATA VALIDATION AND USABILITY

C1 RECONCILIATION WITH USER REQUIREMENTS

Soil Sampling Program/Soil Sample Analysis

A review of the field data will be performed by the Project Manager and the Quality Control Manager as described in Section 4.1 of the QAPP. Independent third party validation of the laboratory analytical results will be performed in accordance with Section 4.2 of the QAPP. The data usability will be evaluated at that time.

ACM Surveys

A review of the data will be performed by the Project Manager and the Quality Control Manager as described in Section 4.1 of the QAPP. An assessment of the data usability will be made based on that evaluation.

TABLES

TABLE 1A
PROJECT TIMELINE - SURFACE SOIL SAMPLING

Activities (Includes Products and/or Services)	Dates *(MM/DD/YY)*	
	Activity Start Date	Activity End Date
Coordinating with excavation contractor and laboratory	05/23/17(1)	05/26/17(1)
Surface soil excavation	05/29/17(1)	05/30/17(1)
Surface soil confirmatory sampling	05/30/17(1)	05/30/17(1)
Laboratory analysis of surface soil samples	05/31/17(1)	06/21/17(1)
Quality assurance/quality control field audits	05/29/17(1)	05/30/17(1)
Data Validation	06/21/17	06/28/17
Data evaluation and report preparation	06/19/17(1)	06/30/17(1)

(1) Assumes USEPA approval of SAP by May 22, 2017.

TABLE 1B
PROJECT TIMELINE - ACM SURVEYS

Activities (Includes Products and/or Services)	Dates *(MM/DD/YY)*	
	Activity Start Date	Activity End Date
Coordinating with ACM survey subconsultant and the BDC	05/23/17(1)	05/26/17(1)
Complete ACM survey	05/29/17(1)	05/29/17(1)
Laboratory analysis of ACM samples	05/30/17(1)	06/07/17(1)
Quality assurance/quality control field audits	05/29/17(1)	05/29/17(1)
Data evaluation and report preparation	06/07/17(1)	06/14/17(1)

(1) Assumes USEPA approval of SAP by May 22, 2017.

TABLE 2
MEASUREMENT QUALITY INDICATORS
SOIL SAMPLES

Constituent	Matrix	Units	Screening Criteria[1]		Reporting Limits	Method Detection Limits	Precision	Accuracy	Completeness
			Industrial Soil Direct Contact	Migration to Groundwater					
Volatile Organic Compounds (Method 8260B)									
1,1,1-Trichloroethane	Soil	mg/Kg	640	1.4	0.005	0.00023	35% RPD	70 - 130%	90%
1,1,2,2-Tetrachloroethane	Soil	mg/Kg	31	0.00053	0.005	0.00026	35% RPD	70 - 130%	90%
1,1,2-Trichloro-1,2,2-trifluoroethane	Soil	mg/Kg	910	2800	0.005	0.00049	35% RPD	70 - 130%	90%
1,1,2-Trichloroethane	Soil	mg/Kg	57	0.032	0.005	0.00039	35% RPD	70 - 130%	90%
1,1-Dichloroethane	Soil	mg/Kg	170	0.014	0.005	0.00033	35% RPD	70 - 130%	90%
1,1-Dichloroethene	Soil	mg/Kg	1100	0.05	0.005	0.00054	35% RPD	70 - 130%	90%
1,2,4-Trichlorobenzene	Soil	mg/Kg	280	4.1	0.005	0.00024	35% RPD	70 - 130%	90%
1,2-Dibromo-3-Chloropropane	Soil	mg/Kg	71	0.0017	0.01	0.00068	35% RPD	70 - 130%	90%
1,2-Dichlorobenzene	Soil	mg/Kg	380	12	0.005	0.00022	35% RPD	70 - 130%	90%
1,2-Dichloroethane	Soil	mg/Kg	23	0.028	0.005	0.00029	35% RPD	70 - 130%	90%
1,2-Dichloropropane	Soil	mg/Kg	47	0.033	0.005	0.00031	35% RPD	70 - 130%	90%
1,3-Dichlorobenzene	Soil	mg/Kg	- -	- -	0.005	0.00029	35% RPD	70 - 130%	90%
1,4-Dichlorobenzene	Soil	mg/Kg	140	1.4	0.005	0.00035	35% RPD	70 - 130%	90%
2-Butanone (MEK)	Soil	mg/Kg	28000	21	0.02	0.00127	35% RPD	70 - 130%	90%
2-Hexanone	Soil	mg/Kg	- -	- -	0.02	0.00058	35% RPD	70 - 130%	90%
4-Methyl-2-pentanone (MIBK)	Soil	mg/Kg	3400	4.7	0.02	0.00089	35% RPD	70 - 130%	90%
Acetone	Soil	mg/Kg	110000	47	0.02	0.00306	35% RPD	70 - 130%	90%
Benzene	Soil	mg/Kg	57	0.051	0.005	0.00032	35% RPD	70 - 130%	90%
Bromoform	Soil	mg/Kg	3100	0.045	0.005	0.0004	35% RPD	70 - 130%	90%
Bromomethane	Soil	mg/Kg	33	0.036	0.005	0.00059	35% RPD	70 - 130%	90%
Carbon disulfide	Soil	mg/Kg	740	4.5	0.005	0.00021	35% RPD	70 - 130%	90%
Carbon tetrachloride	Soil	mg/Kg	32	0.039	0.005	0.00025	35% RPD	70 - 130%	90%
Chlorobenzene	Soil	mg/Kg	760	1.4	0.005	0.00033	35% RPD	70 - 130%	90%
Chlorodibromomethane	Soil	mg/Kg	290	0.0043	0.005	0.0003	35% RPD	70 - 130%	90%
Chloroform	Soil	mg/Kg	15	0.0011	0.005	0.00023	35% RPD	70 - 130%	90%
Chloromethane	Soil	mg/Kg	510	0.98	0.005	0.00038	35% RPD	70 - 130%	90%
Chloroethane	Soil	mg/Kg	2100	120	0.005	0.00038	35% RPD	70 - 130%	90%
cis-1,2-Dichloroethene	Soil	mg/Kg	82	0.41	0.005	0.00028	35% RPD	70 - 130%	90%
cis-1,3-Dichloropropene	Soil	mg/Kg	- -	- -	0.005	0.00026	35% RPD	70 - 130%	90%
Cyclohexane	Soil	mg/Kg	120	260	0.01	0.00021	35% RPD	70 - 130%	90%
Dichlorobromomethane	Soil	mg/Kg	14	0.00064	0.005	0.00033	35% RPD	70 - 130%	90%
Dichlorodifluoromethane	Soil	mg/Kg	800	11	0.005	0.00035	35% RPD	70 - 130%	90%
Ethylbenzene	Soil	mg/Kg	290	16	0.005	0.00027	35% RPD	70 - 130%	90%
1,2-Dibromoethane	Soil	mg/Kg	1.8	0.00028	0.005	0.00035	35% RPD	70 - 130%	90%
Isopropylbenzene	Soil	mg/Kg	270	18	0.005	0.0002	35% RPD	70 - 130%	90%
Methyl acetate	Soil	mg/Kg	29000	21	0.025	0.00117	35% RPD	70 - 130%	90%
Methyl tert-butyl ether	Soil	mg/Kg	2300	0.056	0.005	0.00027	35% RPD	70 - 130%	90%
Methylcyclohexane	Soil	mg/Kg	- -	- -	0.01	0.00023	35% RPD	70 - 130%	90%
Methylene Chloride	Soil	mg/Kg	3300	0.026	0.005	0.00024	35% RPD	70 - 130%	90%
m-Xylene & p-Xylene	Soil	mg/Kg	- -	- -	0.01	0.0004	35% RPD	70 - 130%	90%
o-Xylene	Soil	mg/Kg	- -	- -	0.005	0.00022	35% RPD	70 - 130%	90%
Styrene	Soil	mg/Kg	870	2.2	0.005	0.00027	35% RPD	70 - 130%	90%
Tetrachloroethene	Soil	mg/Kg	170	0.045	0.005	0.00037	35% RPD	70 - 130%	90%
Toluene	Soil	mg/Kg	820	14	0.005	0.00034	35% RPD	70 - 130%	90%
trans-1,2-Dichloroethene	Soil	mg/Kg	700	0.59	0.005	0.00038	35% RPD	70 - 130%	90%

TABLE 2
MEASUREMENT QUALITY INDICATORS
SOIL SAMPLES

Constituent	Matrix	Units	Screening Criteria[1]		Reporting Limits	Method Detection Limits	Precision	Accuracy	Completeness
			Industrial Soil Direct Contact	Migration to Groundwater					
trans-1,3-Dichloropropene	Soil	mg/Kg	- -	- -	0.005	0.00021	35% RPD	70 - 130%	90%
Trichloroethene	Soil	mg/Kg	21	0.036	0.005	0.00041	35% RPD	70 - 130%	90%
Trichlorofluoromethane	Soil	mg/Kg	1200	14	0.005	0.00024	35% RPD	70 - 130%	90%
Xylenes, Total	Soil	mg/Kg	260	200	0.01	0.0004	35% RPD	70 - 130%	90%
Vinyl chloride[1]	Soil	mg/Kg	21	0.014	0.005	0.00028	35% RPD	70 - 130%	90%
Semi-Volatile Compounds (Method 8270C)									
1,1'-Biphenyl	Soil	mg/Kg	220	0.17	0.05	0.0035	35% RPD	70 - 130%	90%
2,2'-oxybis[1-chloropropane]	Soil	mg/Kg	300	0.0024	0.1	0.0095	35% RPD	70 - 130%	90%
2,4,5-Trichlorophenol	Soil	mg/Kg	88000	120	0.15	0.025	35% RPD	70 - 130%	90%
2,4,6-Trichlorophenol	Soil	mg/Kg	880	0.46	0.15	0.0089	35% RPD	70 - 130%	90%
2,4-Dichlorophenol	Soil	mg/Kg	2600	1.1	0.15	0.02	35% RPD	70 - 130%	90%
2,4-Dimethylphenol	Soil	mg/Kg	18000	7.4	0.15	0.02	35% RPD	70 - 130%	90%
2,4-Dinitrophenol	Soil	mg/Kg	1800	0.7	0.33	0.021	35% RPD	70 - 130%	90%
2,4-Dinitrotoluene	Soil	mg/Kg	80	0.0059	0.2	0.017	35% RPD	70 - 130%	90%
2,6-Dinitrotoluene	Soil	mg/Kg	890	0.43	0.2	0.021	35% RPD	70 - 130%	90%
2-Chloronaphthalene	Soil	mg/Kg	64000	41	0.05	0.00045	35% RPD	70 - 130%	90%
2-Chlorophenol	Soil	mg/Kg	5100	0.41	0.05	0.0082	35% RPD	70 - 130%	90%
2-Methylnaphthalene	Soil	mg/Kg	8200	0.51	0.00667	0.0005	35% RPD	70 - 130%	90%
2-Methylphenol	Soil	mg/Kg	44000	13	0.2	0.011	35% RPD	70 - 130%	90%
2-Nitroaniline	Soil	mg/Kg	8500	1.3	0.2	0.0091	35% RPD	70 - 130%	90%
2-Nitrophenol	Soil	mg/Kg	- -	- -	0.05	0.0083	35% RPD	70 - 130%	90%
3 & 4 Methylphenol	Soil	mg/Kg	- -	- -	0.4	0.02	35% RPD	70 - 130%	90%
3,3'-Dichlorobenzidine	Soil	mg/Kg	55	0.02	0.1	0.018	35% RPD	70 - 130%	90%
3-Nitroaniline	Soil	mg/Kg	- -	- -	0.2	0.016	35% RPD	70 - 130%	90%
4,6-Dinitro-2-methylphenol	Soil	mg/Kg	- -	- -	0.15	0.0092	35% RPD	70 - 130%	90%
4-Bromophenyl phenyl ether	Soil	mg/Kg	- -	- -	0.05	0.013	35% RPD	70 - 130%	90%
4-Chloro-3-methylphenol	Soil	mg/Kg	- -	- -	0.15	0.021	35% RPD	70 - 130%	90%
4-Chloroaniline	Soil	mg/Kg	120	0.0029	0.15	0.017	35% RPD	70 - 130%	90%
4-Chlorophenyl phenyl ether	Soil	mg/Kg	- -	- -	0.05	0.013	35% RPD	70 - 130%	90%
4-Nitroaniline	Soil	mg/Kg	- -	- -	0.2	0.026	35% RPD	70 - 130%	90%
4-Nitrophenol	Soil	mg/Kg	- -	- -	0.33	0.017	35% RPD	70 - 130%	90%
Acenaphthene	Soil	mg/Kg	66000	61	0.00667	0.00076	35% RPD	70 - 130%	90%
Acenaphthylene	Soil	mg/Kg	74000	61	0.00667	0.00035	35% RPD	70 - 130%	90%
Acetophenone	Soil	mg/Kg	2500	9.5	0.1	0.0092	35% RPD	70 - 130%	90%
Anthracene	Soil	mg/Kg	610000	3100	0.00667	0.00078	35% RPD	70 - 130%	90%
Atrazine	Soil	mg/Kg	110	0.039	0.2	0.0091	35% RPD	70 - 130%	90%
Benzaldehyde	Soil	mg/Kg	1200	2.2	0.1	0.012	35% RPD	70 - 130%	90%
Benzo[a]anthracene	Soil	mg/Kg	29	0.21	0.00667	0.00063	35% RPD	70 - 130%	90%
Benzo[a]pyrene	Soil	mg/Kg	2.9	4.7	0.00667	0.00064	35% RPD	70 - 130%	90%
Benzo[b]fluoranthene	Soil	mg/Kg	29	0.71	0.00667	0.00059	35% RPD	70 - 130%	90%
Benzo[g,h,i]perylene	Soil	mg/Kg	23000	37000	0.00667	0.00035	35% RPD	70 - 130%	90%
Benzo[k]fluoranthene	Soil	mg/Kg	290	6.9	0.00667	0.00068	35% RPD	70 - 130%	90%
Bis(2-chloroethoxy)methane	Soil	mg/Kg	- -	- -	0.1	0.022	35% RPD	70 - 130%	90%

TABLE 2
MEASUREMENT QUALITY INDICATORS
SOIL SAMPLES

Constituent	Matrix	Units	Screening Criteria[1]		Reporting Limits	Method Detection Limits	Precision	Accuracy	Completeness
			Industrial Soil Direct Contact	Migration to Groundwater					
Bis(2-chloroethyl)ether	Soil	mg/Kg	13	0.000063	0.1	0.002	35% RPD	70 - 130%	90%
Bis(2-ethylhexyl) phthalate	Soil	mg/Kg	1800	29	0.07	0.019	35% RPD	70 - 130%	90%
Butyl benzyl phthalate	Soil	mg/Kg	13000	10	0.07	0.01	35% RPD	70 - 130%	90%
Caprolactam	Soil	mg/Kg	440000	39	0.33	0.037	35% RPD	70 - 130%	90%
Carbazole	Soil	mg/Kg	- -	- -	0.05	0.027	35% RPD	70 - 130%	90%
Chrysene	Soil	mg/Kg	2900	21	0.00667	0.0011	35% RPD	70 - 130%	90%
Dibenz(a,h)anthracene	Soil	mg/Kg	2.9	0.23	0.00667	0.00066	35% RPD	70 - 130%	90%
Dibenzofuran	Soil	mg/Kg	2000	5.8	0.05	0.00066	35% RPD	70 - 130%	90%
Diethyl phthalate	Soil	mg/Kg	700000	100	0.07	0.016	35% RPD	70 - 130%	90%
Dimethyl phthalate	Soil	mg/Kg	- -	- -	0.07	0.017	35% RPD	70 - 130%	90%
Di-n-butyl phthalate	Soil	mg/Kg	88000	79	0.07	0.015	35% RPD	70 - 130%	90%
Di-n-octyl phthalate	Soil	mg/Kg	- -	- -	0.07	0.0079	35% RPD	70 - 130%	90%
Fluoranthene	Soil	mg/Kg	30000	1400	0.00667	0.00055	35% RPD	70 - 130%	90%
Fluorene	Soil	mg/Kg	57000	74	0.00667	0.00053	35% RPD	70 - 130%	90%
Hexachlorobenzene	Soil	mg/Kg	15	0.25	0.00667	0.0021	35% RPD	70 - 130%	90%
Hexachlorobutadiene	Soil	mg/Kg	320	0.033	0.05	0.0056	35% RPD	70 - 130%	90%
Hexachlorocyclopentadiene	Soil	mg/Kg	5300	3.1	0.33	0.0081	35% RPD	70 - 130%	90%
Hexachloroethane	Soil	mg/Kg	620	0.02	0.05	0.009	35% RPD	70 - 130%	90%
Indeno[1,2,3-cd]pyrene	Soil	mg/Kg	29	2.3	0.00667	0.00035	35% RPD	70 - 130%	90%
Isophorone	Soil	mg/Kg	26000	0.47	0.05	0.013	35% RPD	70 - 130%	90%
Naphthalene	Soil	mg/Kg	180	0.0094	0.00667	0.00082	35% RPD	70 - 130%	90%
Nitrobenzene	Soil	mg/Kg	240	0.0016	0.1	0.0022	35% RPD	70 - 130%	90%
N-Nitrosodi-n-propylamine	Soil	mg/Kg	3.5	0.00014	0.05	0.0063	35% RPD	70 - 130%	90%
N-Nitrosodiphenylamine	Soil	mg/Kg	5000	1.5	0.05	0.021	35% RPD	70 - 130%	90%
Pentachlorophenol	Soil	mg/Kg	33	0.2	0.15	0.0091	35% RPD	70 - 130%	90%
Phenanthrene	Soil	mg/Kg	610000	3200	0.00667	0.00073	35% RPD	70 - 130%	90%
Phenol	Soil	mg/Kg	260000	54	0.05	0.0073	35% RPD	70 - 130%	90%
Pyrene	Soil	mg/Kg	58000	320	0.00667	0.00044	35% RPD	70 - 130%	90%
Metals (Method 6020)									
Aluminum	Soil	mg/Kg	1000000	470000	0.01	0.00062	35% RPD	60 - 140%	90%
Arsenic	Soil	mg/Kg	27	5.8	0.001	0.000026	35% RPD	60 - 140%	90%
Barium	Soil	mg/Kg	360000	1600	0.001	0.00022	35% RPD	60 - 140%	90%
Beryllium	Soil	mg/Kg	3900	63	0.0002	0.000011	35% RPD	60 - 140%	90%
Cadmium	Soil	mg/Kg	800	7.5	0.0002	0.0000037	35% RPD	60 - 140%	90%
Calcium	Soil	mg/Kg	- -	- -	0.2	0.022	35% RPD	60 - 140%	90%
Chromium	Soil	mg/Kg	- -	- -	0.0004	0.00006	35% RPD	60 - 140%	90%
Cobalt	Soil	mg/Kg	600	4.2	0.0002	0.0000017	35% RPD	60 - 140%	90%
Copper	Soil	mg/Kg	82000	440	0.0004	0.000097	35% RPD	60 - 140%	90%
Iron	Soil	mg/Kg	1000000	5500	0.02	0.0032	35% RPD	60 - 140%	90%
Silver	Soil	mg/Kg	10000	13	0.0002	0.0000014	35% RPD	60 - 140%	90%
Potassium	Soil	mg/Kg	- -	- -	0.2	0.0049	35% RPD	60 - 140%	90%
Magnesium	Soil	mg/Kg	- -	- -	0.2	0.004	35% RPD	60 - 140%	90%
Manganese	Soil	mg/Kg	72000	960	0.001	0.00012	35% RPD	60 - 140%	90%
Sodium	Soil	mg/Kg	- -	- -	0.2	0.0087	35% RPD	60 - 140%	90%
Nickel	Soil	mg/Kg	38000	410	0.0004	0.000039	35% RPD	60 - 140%	90%
Lead	Soil	mg/Kg	1000	270	0.0002	0.000045	35% RPD	60 - 140%	90%
Antimony	Soil	mg/Kg	820	5.7	0.0004	0.000014	35% RPD	60 - 140%	90%
Selenium	Soil	mg/Kg	10000	5.2	0.001	0.00004	35% RPD	60 - 140%	90%

TABLE 2
MEASUREMENT QUALITY INDICATORS
SOIL SAMPLES

Constituent	Matrix	Units	Screening Criteria[1]		Reporting Limits	Method Detection Limits	Precision	Accuracy	Completeness
			Industrial Soil Direct Contact	Migration to Groundwater					
Thallium	Soil	mg/Kg	20	2.8	0.0004	0.000019	35% RPD	60 - 140%	90%
Vanadium	Soil	mg/Kg	140	22	0.001	0.000037	35% RPD	60 - 140%	90%
Zinc	Soil	mg/Kg	610000	5800	0.004	0.0005	35% RPD	60 - 140%	90%
Mercury (Method 7471A)									
Mercury	Soil	mg/Kg	610	2.1	0.0001	0.000018	35% RPD	60 - 140%	90%
PCBs - All Aroclors (Method 8082)									
PCB-1016	Soil	mg/Kg	50	1.8	0.05	0.024	35% RPD	70 - 130%	90%
PCB-1221	Soil	mg/Kg	12	0.0023	0.05	0.023	35% RPD	70 - 130%	90%
PCB-1232	Soil	mg/Kg	12	0.0023	0.05	0.016	35% RPD	70 - 130%	90%
PCB-1242	Soil	mg/Kg	10	0.11	0.05	0.02	35% RPD	70 - 130%	90%
PCB-1248	Soil	mg/Kg	10	0.1	0.05	0.017	35% RPD	70 - 130%	90%
PCB-1254	Soil	mg/Kg	10	0.18	0.05	0.014	35% RPD	70 - 130%	90%
PCB-1260	Soil	mg/Kg	10	0.47	0.05	0.018	35% RPD	70 - 130%	90%

Notes:
(1) Screening criteria are based on the De Minimis Values from Table 60-3B of the West Virginia Voluntary Remediation and Redevelopment Rule. Effective June 2014. Notes regarding specific values for various chemicals (e.g., surrogates used, effects basis, etc.) are as follows:

- - Indicates screening value not available for this constituent.
Screening criteria for vinyl chloride is based on the adult values.

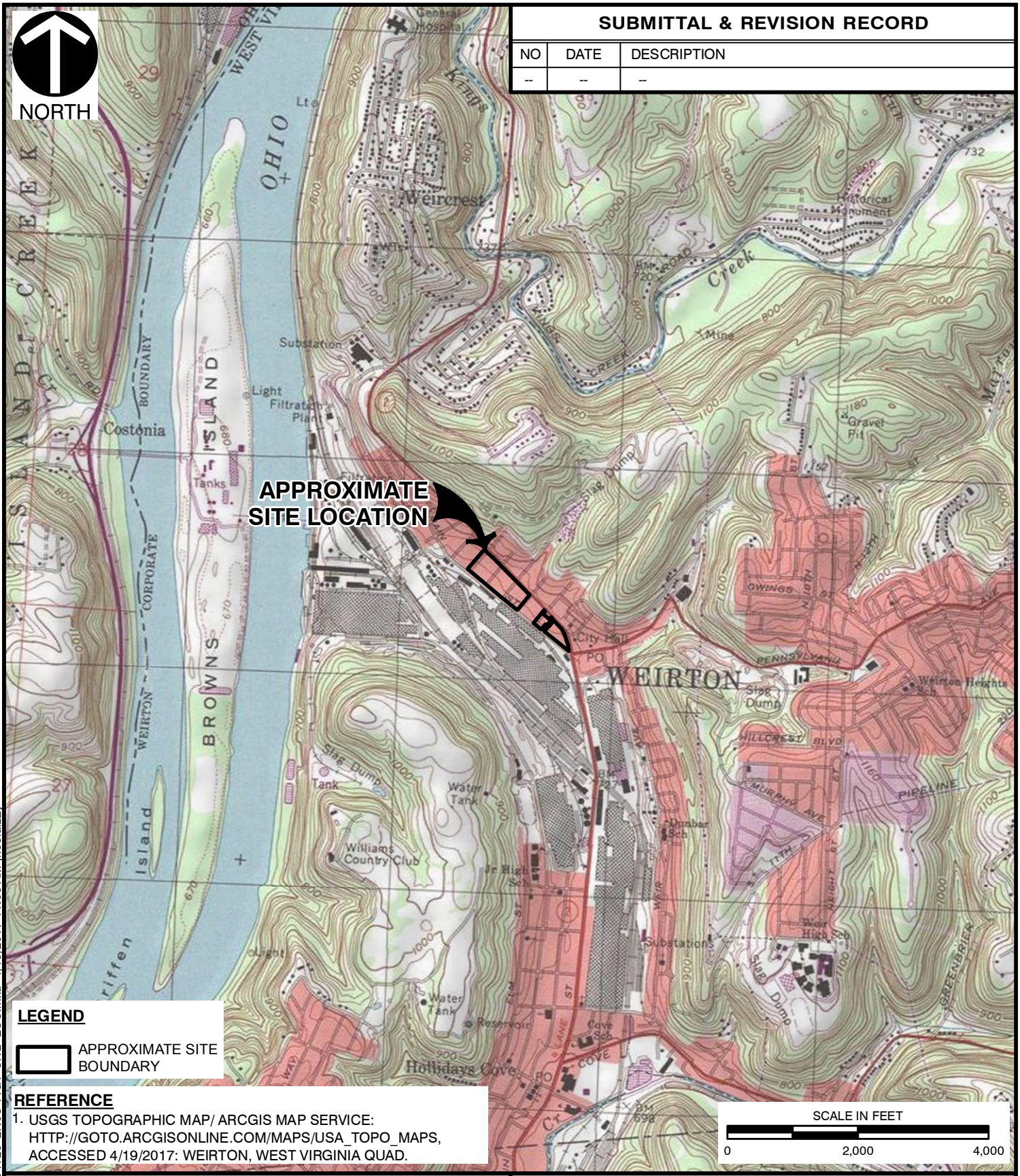
TABLE 3
SAMPLING AND ANALYTICAL METHODS REQUIREMENTS

Matrix/Sample Locations	Parameter	Number of Samples[(1)]	Sampling Procedure[(2)]	Sample Preparation/Extraction Method Number	Analytical Method Number
Soil from Base of Excavations	TCL VOCs	4	SOP #03-01-04	USEPA SW-846 Method 5035A	USEPA SW-846 Method 8260B
	TCL SVOCs	4	SOP #03-01-04	USEPA SW-846 Method 3540C	USEPA SW-846 Method 8270C
	TAL Metals (except Mercury)	4	SOP #03-01-04	USEPA SW-846 Method 3050B	USEPA SW-846 Method 6020
	Mercury	4	SOP #03-01-04	USEPA SW-846 Method 7471A	USEPA SW-846 Method 7471A
	PCBs	4	SOP #03-01-04	USEPA SW-846 Method 3540C	USEPA SW-846 Method 8082

(1) The number of samples listed does not include quality assurance samples (trip blanks, field duplicates, and equipment blanks). Quality assurance samples will be collected and analyzed at the frequency listed on Table 2 of the QAPP.-1

(2) Standard Operating Procedures (SOPs) listed in this table are attached in Appendix E. These SOPs are intended to supplement those presented in the QAPP.

FIGURES



SUBMITTAL & REVISION RECORD

NO	DATE	DESCRIPTION
--	--	--

LEGEND

APPROXIMATE SITE BOUNDARY

REFERENCE

1. USGS TOPOGRAPHIC MAP/ ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/USA_TOPO_MAPS, ACCESSED 4/19/2017: WEIRTON, WEST VIRGINIA QUAD.

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BUISNESS DEVELOPMENT CORPORATION OF THE NORTHERN PANHANDLE
MACHINE SHOP PROPERTY
WEIRTON, HANCOCK COUNTY, WEST VIRGINIA

SITE LOCATION MAP

DRAWN BY:	KMC	CHECKED BY:	AJG	APPROVED BY:	DNO*	FIGURE NO:	1
DATE:	04/19/2017	SCALE:	1 " = 2,000 '	PROJECT NO:	164-123	* Hand signature on file	

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SUBMITTAL & REVISION RECORD		
NO	DATE	DESCRIPTION
--	--	--

NORTH

Electric Control Building
Steam Plant
City Fire Department
Transformer
Compressor Shed
Wastewater Sump
Waste Oil Tank
Machine Shop
Approximate Site Boundary
City Public Works Building
Shed
Former Diesel & Coherex ASTs
Office/Locker Room Building
Former Gasoline AST
Hoist Shed
Former Blast Furnaces
Truck Garage
Trucking Department Maintenance Building
Above Ground Piping
Hoist Shed
Sandwich Shop
Locker Room Building
Electronics Repair Shop
Former Open Hearth

SCALE IN FEET
0 200 400

LEGEND

- GROUNDWATER MONITORING WELL
- WASTEWATER SUMP
- APPROXIMATE SITE BOUNDARY

REFERENCE

1. AERIAL PHOTOGRAPHY COPYRIGHT GOOGLE EARTH PRO, EXPORTED 02/16/2017 IMAGERY DATE 08/21/2015.

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SITE LAYOUT MAP

DRAWN BY:	KMC	CHECKED BY:	AJG	APPROVED BY:	DNO*	FIGURE NO:	2
DATE:	04/19/2017	SCALE:	1 " = 200 '	PROJECT NO:	164-123	* Hand signature on file	

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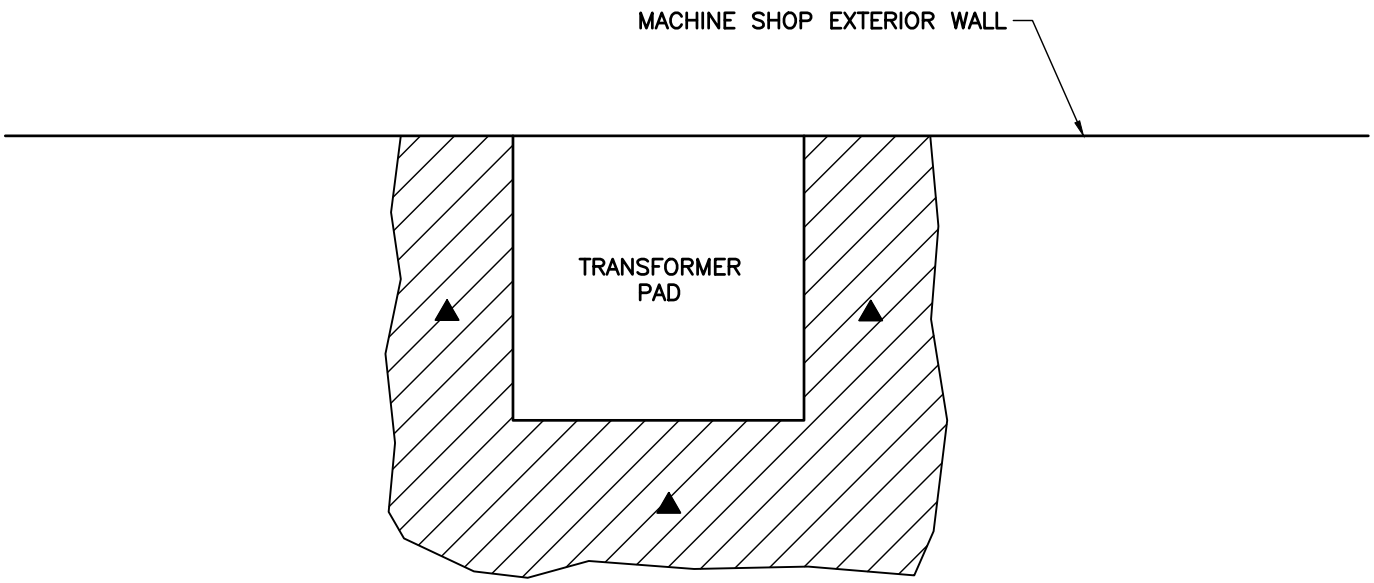

LEGEND

SOIL EXCAVATION AREA

CONFIRMATORY SOIL SAMPLE

SCALE IN FEET

0 5 10

*HAND SIGNATURE ON FILE

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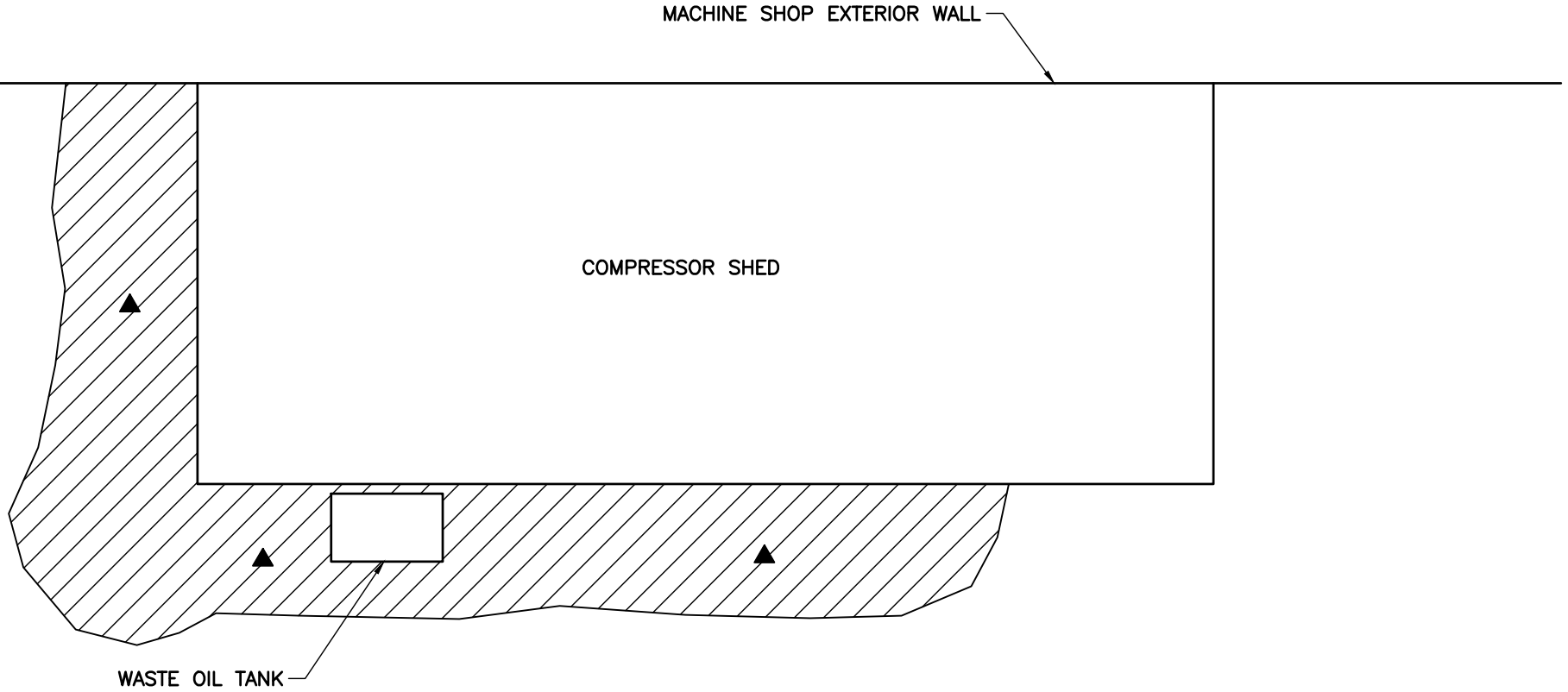
TRANSFORMER SOIL EXCAVATION & SAMPLING

DRAWN BY:	JHG	CHECKED BY:	DNO	APPROVED BY:	*EAS	FIGURE NO.:	3
DATE:	APRIL 25, 2017	DWG SCALE:	1"=5'	PROJECT NO:	164-123.2H2C		

P:\2016\164-123\-CADD\Dwg\EV01\164123-EV01-FIGURE-3-5.dwg{FIGURE 3} LS:(4/25/2017 - jgilligan) - LP: 4/25/2017 9:23 AM



LEGEND

SOIL EXCAVATION AREA

CONFIRMATORY SOIL SAMPLE

SCALE IN FEET

0 5 10

*HAND SIGNATURE ON FILE

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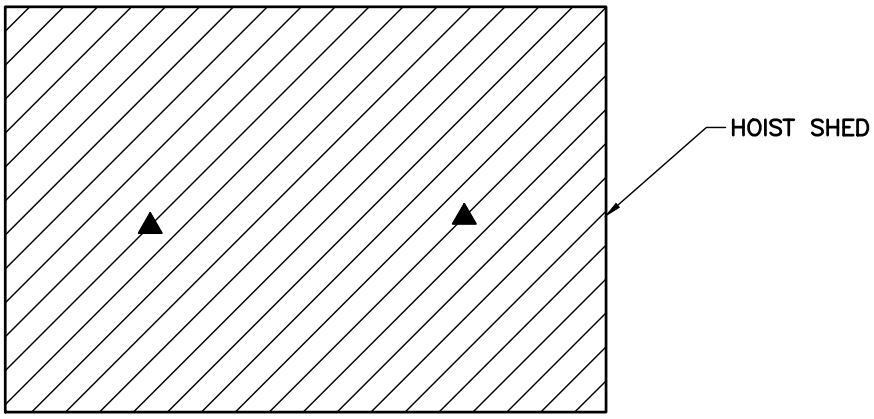
COMPRESSOR SHED SOIL
EXCAVATION & SAMPLING

DRAWN BY:	JHG	CHECKED BY:	DNO	APPROVED BY:	*EAS	FIGURE NO.:	4
DATE:	APRIL 25, 2017	DWG SCALE:	1"=5'	PROJECT NO:	164-123.2H2C		



LEGEND

SOIL EXCAVATION AREA

CONFIRMATORY SOIL SAMPLE

SCALE IN FEET

0 5 10

*HAND SIGNATURE ON FILE

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HOIST SHED SOIL
EXCAVATION & SAMPLING

DRAWN BY:	JHG	CHECKED BY:	DNO	APPROVED BY:	*EAS	FIGURE NO.:
DATE:	APRIL 25, 2017	DWG SCALE:	1"=5'	PROJECT NO:	164-123.2H2C	5

APPENDIX A

LABORATORY QUALIFICATIONS PACKAGE
TESTAMERICA CANTON

Quality Assurance Manual

TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Phone: 330-497-9396
Fax: 330-497-0772

www.testamericainc.com

Facility Distribution No. _____ **Distributed To:** _____

The controlled copies of this SOP are the PDF copy of the SOP that is posted to the laboratory's SOP Directory and, where applicable, the SOP that is printed and placed in the General Chemistry SOP binder. Printed or electronic copies of this SOP distributed outside of the facility are considered uncontrolled.

Title Page:

Quality Assurance Manual

Approval Signatures

Laboratory Director – Carolynne M. Roach — 12/5/16

Date

Quality Assurance Manager – Mark J. Loeb — 12/5/16

Date

Technical Director – Raymond Risden — 12/6/16

Date

Operations Manager – Aaron Martin — 12/5/16

Date

SECTION 2. TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-I-P-002	Electronic Reporting and Signature Policy
CA-L-P-002	Contract Compliance Policy
CA-L-S-004	Subcontracting
CA-Q-M-002	Corporate Quality Management Plan
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-006	Detection Limits
CA-Q-S-009	Root Cause Analysis
CA-T-P-001	Qualified Products List
CW-E-M-001	Corporate Environmental Health & Safety Manual
CW-F-P-002	Company-Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization
CW-L-P-004	Ethics Policy
CW-L-S-002	Internal Investigation
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review
CW-Q-S-005	Data Recall Process
CA-C-S-001	Work Sharing Process

REFERENCED LABORATORY SOPs

SOP / Policy Reference	Title
NC-QA-015	Balance and Thermometer Calibration, Container Verification
NC-QA-018	Statistical Evaluation of Data and Development of Control Charts
NC-QA-019	Records Information Management
NC-QA-027	Preparation and Management of SOPs
NC-QA-028	Employee Orientation and Training
NC-QA-029	Nonconformance and Corrective Action System
NC-QA-030	Document Control
NC-SC-005	Sample Receiving and Sample Control
NC-SC-006	Sample Procurement Protocol
CA-Q-T-005	Laboratory Documentation
NC-QA-021	Evaluation of Method Detection Limits for Chemical Tests
NC-QA-031	Internal Audits

SECTION 3. INTRODUCTION, SCOPE, AND APPLICABILITY

3.1 Introduction and Compliance References

TestAmerica Canton's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organizational objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.The QAM has been prepared to assure compliance with The NELAC Institute (TNI) Standard, dated 2009, Volume 1, Modules 2 and 4, In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 4. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations. The QAM has been prepared to be consistent with the requirements of the following documents:

- "EPA Requirements for Quality Management Programs" (QA/R-2) (EPA/240/B-01/002, May 31, 2006).
- EPA 600/4-79-019, Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA, March 1979.
- Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008*; Final Update V, August 2015*.
- APHA, Standard Methods for the Examination of Water and Wastewater, 18th Edition, 19th, 20th, 21st, and on-line Editions.
- Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- Toxic Substances Control Act (TSCA).

3.2 Terms and Definitions

A Quality Assurance Program is a company-wide system designed to ensure data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 3 for the Glossary/Acronyms.

3.3 Scope / Fields of Testing

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices include, but are not limited to, effluent water, groundwater, hazardous waste, sludge, wipes, and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Appendix 2 . The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual and the referenced methods. In these cases, the laboratory must abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and/or the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

Ohio VAP requirements are listed throughout the document.

3.4 Management Of The Manual

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure it remains in compliance with Section 3.1. This manual itself is reviewed every two years by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager must review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates must be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control SOP (NC-QA-030) and Updating Procedures SOP (NC-QA-027).

SECTION 4. MANAGEMENT REQUIREMENTS

4.1 Overview

TestAmerica Canton is a local operating unit of TestAmerica Laboratories, Inc. The organizational structure, responsibilities, and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent

operational authority overseen by corporate officers (e.g., President and Chief Executive Officer (CEO), Chief Operating Officer (COO), Executive VP Operations, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate and TestAmerica Canton is presented in Figure 4-1. Employee names are provided to demonstrate range and size of departments however the actual staff members may vary over time. The most current Organization Chart may be obtained from Quality Assurance Manager or Laboratory Director. **Roles and Responsibilities**

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Canton laboratory.

Canton Laboratory Key Personnel

Name	Position
Rusty Vicinie	VP of Operations, Central
Carolynne M. Roach	Laboratory Director
Raymond Risden	Technical Director
Aaron M. Martin	Operations Manager
Mark J. Loeb	Quality Assurance Manager
Tom Stiller	GC/MS Volatiles Group Leader
Steve Jackson	Regional Safety Director, Waste Management Supervisor
Caitlin Scott	Extractions Group Leader
Will Cordell	Field Analytical Group Leader
Olguita Colon	GC Volatile/Semivolatiles Group Leader
Tom Hula	GC/MS Semivolatiles Group Leader
Lucas Grossman	General Chemistry Group Leader
Darren Miller	Maintenance
Karen Counts	Metals Group Leader
Patrick O'Meara	Project Management Group Leader
Heather Migoni	Sample Control Group Leader

Name	Position
Lance Hershman	Shipping Group Leader

4.2.2 President and Chief Executive Office (CEO)

The President and CEO is a member of the Board of Directors and is ultimately responsible for the quality and performance of all TestAmerica facilities. The President and CEO establishes the overall quality standard and data integrity program for the Analytical Business, providing the necessary leadership and resources to assure that the standard and integrity program are met.

4.2.3 Chief Operation Officer (COO)

The COO reports directly to the President and CEO or TestAmerica. The COO oversees the operations of all TestAmerica laboratories and the EMLab P&K business unit. The VP's of Operations report directly to COO.

4.2.4 Vice President of Operations

Each VP of Operations reports directly to the Chief Operating Officer and is a part of the Executive Committee. Each VP of Operations is responsible for the overall administrative and operational management of their respective laboratories. The VP's responsibilities include allocation of personnel and resources, long-term planning, goal setting, and achieving the financial, business, and quality objectives of TestAmerica. The VP's ensure timely compliance with Corporate Management directives, policies, and management systems reviews. The VP's are also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.5 Vice President of Quality and Environmental Health and Safety (VP-QA/EHS)

The Vice President (VP) of QA/EHS reports directly to the President and CEO. With the aid of the Executive Committee, Laboratory Directors, Quality Directors, Safety Manager, EH&S Coordinators, and QA Managers, the VP-QA-EHS has the responsibility for the establishment, general overview and Corporate maintenance of the Quality Assurance and EH&S Programs within TestAmerica. Additional responsibilities include:

- Review of QA/QC and EHS aspects of Corporate SOPs & Policies, national projects and expansions or changes in services.
- Work with various organizations outside of TestAmerica to further the development of quality standards and represent TestAmerica at various trade meetings.
- Preparation of a monthly report that includes quality metrics across the analytical laboratories and a summary of any quality related initiatives and issues.
- Preparation of a monthly report that includes EH&S metrics across the analytical laboratories and a summary of any EH&S relates initiatives and issues.
- With the assistance of the Corporate Senior Management Teams and the EHS Directors, development and implementation of the TestAmerica Environmental, Health, and Safety Program.

4.2.6 Vice President of Client Services

The VP of Client Services leads the Client Service Organization (CSO) and is responsible for client satisfaction, driving operational excellence and improving client responsiveness. The VP provides direction to the Client Service Directors, Program Managers, and Project Managers.

4.2.7 Quality Assessment Director

The Quality Assessment Director reports to the VP-QA/EHS. The Quality Assessment Director has QA oversight of laboratories; responsible for the internal audit system, schedule and procedure; monitors laboratory internal audit findings; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Compliance Director, the Quality Systems Director, and the VP-QA/EHS, the Quality Assessment Director has the responsibility for the establishment, general overview, and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.8 Quality Compliance Director

The Quality Compliance Director reports to the VP-QA/EHS. The Quality Compliance Director has QA oversight of laboratories; monitors and communicates DoD/DoE requirements; develops corporate tools for ensuring and improving compliance; develops corporate assessment tools; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Assessment Director, the Quality Systems Director, and the VP-QA/EHS, the Quality Compliance Director has the responsibility for the establishment, general overview, and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.9 Quality Systems Director

The Quality Systems Director reports to the VP-QA/EHS. The Quality Systems Director has QA oversight of laboratories; develops quality policies, procedures and management tools; monitors and communicates regulatory and certification requirements; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Assessment Director, Quality Compliance Director, and the VP-QA/EHS, the Quality Systems Director has the responsibility for the establishment, general overview, and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.10 Quality Information Manager

The Quality Information Manager is responsible for managing all company official documents (e.g., Policies, Procedures, Work Instructions), the company's accreditation database, intranet websites, external laboratory subcontracting, regulatory limits for clients on the company's TotalAccess website; internal and external client support for various company groups (e.g., Client Services, EH&S, Legal, IT, Sales) for both quality and operational functions. The Quality Information Manager reports to the VP-QA/EHS and works alongside the Quality Assessment, Quality Compliance and Quality Systems Directors and EHS Managers to support both the Analytical Quality Assurance and EHS Programs within TestAmerica.

4.2.11 Technical Services Director

The Technical Services Director is responsible for establishing, implementing and communicating TestAmerica's Analytical Business's Technical Policies, SOPs, and Manuals. Other responsibilities include conducting technical assessments as required, acting as a technical resource in national contracts review, coordinating new technologies, establishing best practices, advising staff on technology advances, innovations, and applications.

4.2.12 Ethics and Compliance Officers (ECOs)

TestAmerica has designated two senior members of the Corporate staff to fulfill the role of Ethics and Compliance Officer (ECO) – Corporate Counsel & VP of Human Resources and the VP-QA/EHS. Each ECO acts as a back-up to the other ECO and both are involved when data investigations occur. Each ECO has a direct line of communication to the entire senior Corporate and lab management staff.

The ECOs ensure that the organization distributes the data integrity and ethical practices policies to all employees and ensures annual trainings and orientation of new hires to the ethics program and its policies. The ECO is responsible for establishing a mechanism to foster employee reporting of incidents of illegal, unethical, or improper practices in a safe and confidential environment.

The ECOs monitor and audit procedures to determine compliance with policies and to make recommendations for policy enhancements to the President and CEO, VPOs, Laboratory Director or other appropriate individuals within the laboratory. The ECO will assist the laboratory QA Manager in the coordination of internal auditing of ethical policy related activities and processes within the laboratory, in conjunction with the laboratories regular internal auditing function.

The ECOs will also participate in investigations of alleged violations of policies and work with the appropriate internal departments to investigate misconduct, remedy the situation, and prevent recurrence of any such activity.

4.2.13 Chief Information Officer (CIO)

The CIO is responsible for establishing, implementing and communicating TestAmerica's Information Technology (IT) Policies, SOPs and Manuals. Other responsibilities include coordinating new technologies, development of electronic communication tools such as TestAmerica's intranet and internet sites, ensuring data security and documentation of software, ensuring compliance with the NELAC standard, and assistance in establishing, updating, and maintaining Laboratory Information Management Systems (LIMS) at the various TestAmerica facilities.

4.2.14 Environmental Health and Safety Managers (Corporate)

The EHS Managers report directly to the VP-QA/EHS. Director of Quality and EHS. The EHS Managers are responsible for the development and implementation of the TestAmerica Environmental, Health and Safety program. Responsibilities include:

- Consolidation and tracking all safety and health-related information and reports for the company, and managing compliance activities for TestAmerica locations.
- Coordination/preparation of the corporate Environmental, Health and Safety Manual Template that is used by each laboratory to prepare its own laboratory-specific Safety Manual/ CHP.
- Preparation of information and training materials for laboratory EHS Coordinators.
- Assistance in the internal and external coordination of employee exposure and medical monitoring programs to insure compliance with applicable safety and health regulations.
- Serving as Department of Transportation (D.O.T.) focal point and providing technical assistance to location management.
- Serving as Hazardous Waste Management main contact and providing technical assistance to location management.

4.2.15 Laboratory Director

TestAmerica Canton's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective VPO. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Provides one or more technical managers for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves SOPs as directed by the Quality Assurance department prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, the Technical Manager(s), and the Operations Manager as direct reports.

4.2.16 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system.

The QA Manager reports directly to the Laboratory Director and their Corporate Quality Director. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications, and other quality assurance related items. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QA Manual.
- Monitoring and evaluating laboratory certifications, scheduling proficiency testing (PT) samples.
- Monitoring and communicating to management, regulatory changes that may affect the laboratory.
- Training and advising the laboratory staff on quality assurance/quality control (QA/QC) procedures that are pertinent to their daily activities.
- Having documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- Maintaining records of all ethics-related training, including the type and proof of attendance.
- Maintaining, improving, and evaluating the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QA Manual or laboratory SOPs shall be investigated following procedures outlined in Section 12; and if deemed necessary, may be temporarily suspended during the investigation.
- Objectively monitoring standards of performance in QC and QA without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDL, control limits, and miscellaneous forms and information.
- Reviewing a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness

of any corrective action statements, evaluate manual calculations, format, holding time, reasonableness of results and completeness of the project file contents.

- Reviewing external audit reports and data validation requests.
- Following up with data and laboratory audits to ensure client QAPP requirements are met.
- Establishing reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Developing suggestions and recommendations to improve quality systems.
- Researching current state and federal requirements and guidelines.
- Captaining the QA team to enable communication and to distribute duties and responsibilities.
- Ensuring communication and monitoring standards of performance to ensure systems are in place to produce the level of quality as defined in this document.
- Evaluating the thoroughness and effectiveness of training.

4.2.17 Technical Director

The Technical Director reports directly to the Laboratory Director. The Technical Director along with the Laboratory Director, the QA Manager, the Operations Manager, and each Department Group Leader is accountable for all analyses and analysts under their experience supervision. The Technical Director works with QA and Department Group Leaders to solve day-to-day technical issues, provide technical training and guidance to laboratory staff, project managers, and clients, and assists with method development and validation. These responsibilities include but are not limited to:

- Day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Working with the QA Manager to coordinate preparation of test method SOPs and perform subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples and/or requirements. Develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.

- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a continuing, scheduled basis. Training includes instruction on calculations, instrumentation, troubleshooting, and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances and improved laboratory information management system (LIMS) utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Captains department personnel to communicate quality, technical, personnel and instrumental issues for a consistent team approach.

4.2.18 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory. He/She reports directly to the Laboratory Director and assists the Technical Manager in determining the most efficient instrument utilization. More specifically, the Operations Manager:

- Evaluates the level of internal/external non-conformances for all departments.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the Technical Manager and QA Manager and in compliance with regulatory requirements.
- Works with the Preventive Maintenance Coordinator to ensure that scheduled instrument maintenance is completed.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.
- Works with the QA Manager in scheduling all QA/QC-related requirements for compliance, e.g. MDLs, etc.
- Exercises day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i. e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. Insures that the SOPs are properly managed and adhered to at the bench. Together with the Technical Director, the Operations Manager develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.

4.2.19 Environmental Health and Safety Coordinator

The Environmental Health and Safety Coordinator reports directly to the Laboratory Director. The EH&S Coordinator is responsible for:

- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.

- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.
- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is "reasonable" and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica's medical consultants.

4.2.20 Department Group Leaders

Department Group Leaders report to the Operations Manager. Each one is responsible to:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- With regard to analysts, participates in the selection, training (as documented in Section 8.1), development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.
- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Manager, Operations Manager, and/or QA

Manager. Each is responsible for 100% of the data review and documentation, non-conformance issues, the timely and accurate completion of performance evaluation samples and MDLs, for the department.

- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Manager, Operations Manager, and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.21 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Manager, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Manager, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.22 Project Manager (PM)

The PM reports to the Manager of Project Management (MPM) and serves as the interface between the laboratory's technical departments and the laboratory's clients. There is an entire staff of Project Managers that makes up the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).

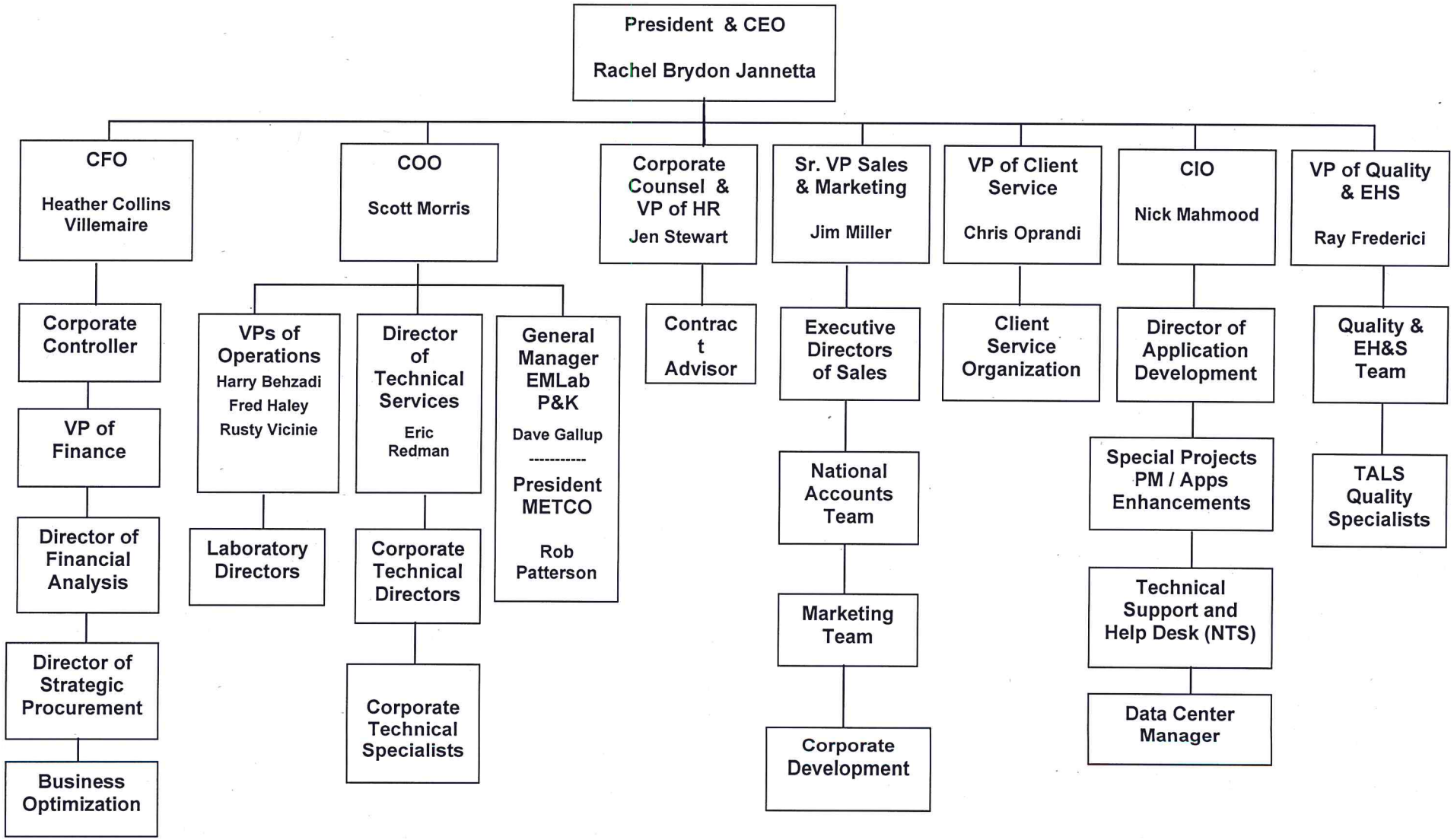
4.3 Deputies

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy
Laboratory Director	Technical Director QA Manager
Operations Manager	Technical Director Laboratory Director
Quality Assurance Manager	Quality Assurance Coordinator Laboratory Director
Technical Director	Operations Manager Laboratory Group Leaders
EHS Coordinator	EHS Manager Facilities Manager

Figure 4-1. Corporate and Laboratory Organization Charts

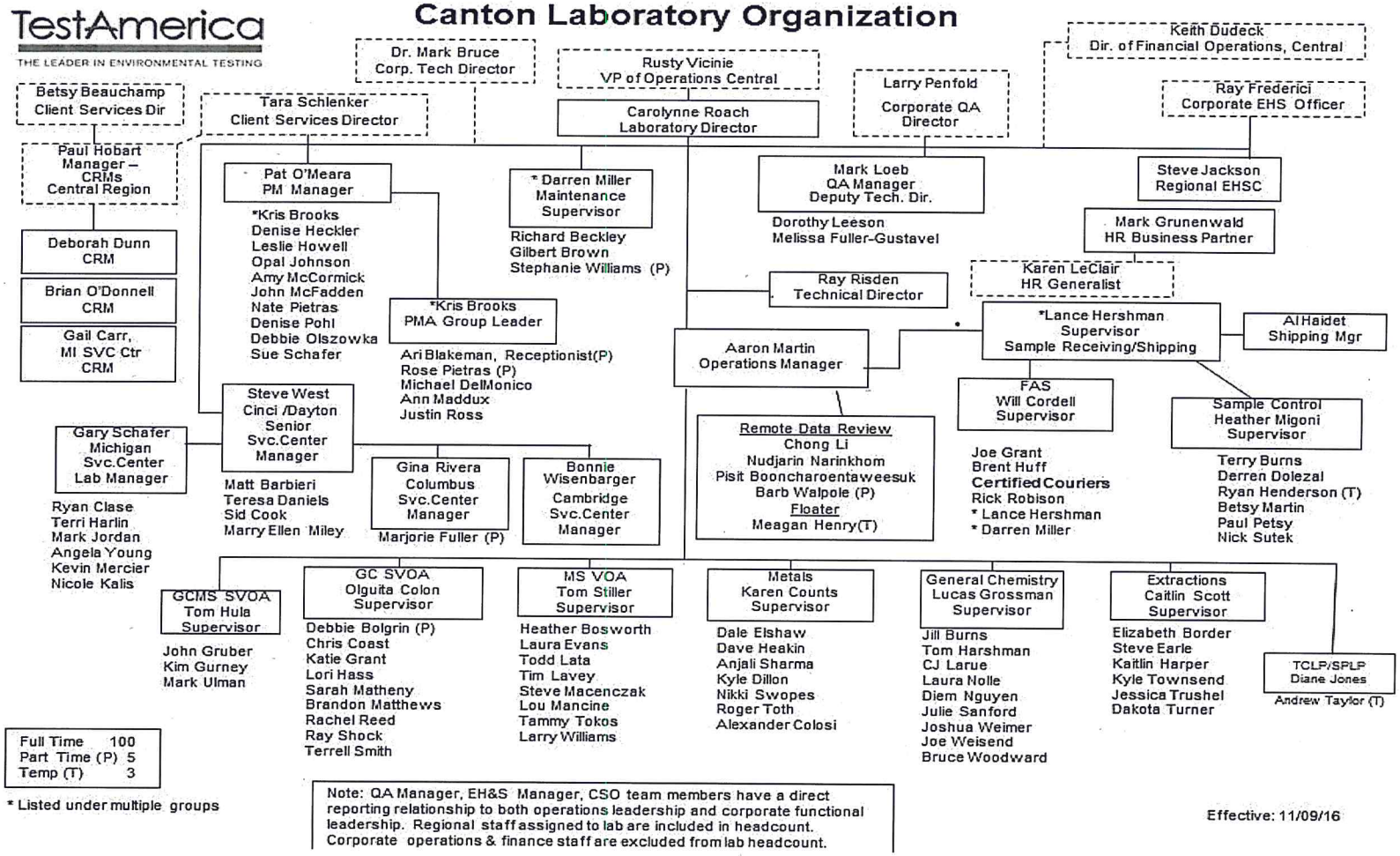
Note: *Organization Charts are subject to change without notice.*


President & CEO
Rachel Brydon Jannetta
CFO
Heather Collins Villemaire
COO
Scott Morris
Corporate Counsel & VP of HR
Jen Stewart
Sr. VP Sales & Marketing
Jim Miller
VP of Client Service
Chris Oprandi
CIO
Nick Mahmood
VP of Quality & EHS
Ray Frederici
Corporate Controller
VP of Finance
Director of Financial Analysis
Director of Strategic Procurement
Business Optimization
VPs of Operations
Harry Behzadi
Fred Haley
Rusty Vicinie
Laboratory Directors
Director of Technical Services
Eric Redman
Corporate Technical Directors
Corporate Technical Specialists
General Manager EMLab P&K
Dave Gallup

President METCO
Rob Patterson
Contrac t Advisor
Executive Directors of Sales
National Accounts Team
Marketing Team
Corporate Development
Client Service Organization
Director of Application Development
Special Projects PM / Apps Enhancements
Technical Support and Help Desk (NTS)
Data Center Manager
Quality & EH&S Team
TALS Quality Specialists

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Canton Laboratory Organization



SECTION 5. QUALITY SYSTEM

5.1 Quality Policy Statement

It is TestAmerica's policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements, and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative, and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- Comply with the ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard, and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document

5.2 Ethics and Data Integrity

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of the TestAmerica Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy CW-L-P-004) and Employee Ethics Statements
- Ethics and Compliance Officers (ECOs)
- A training program
- Self-governance through disciplinary action for violations
- A confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct (Corporate SOP CW-L-S-002)
- Procedures and guidance for recalling data if necessary (Corporate SOP CA-Q-S-005)
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15)

- Production of results which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Presenting services in a confidential, honest, and forthright manner.
- Providing employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operating our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obeying all pertinent federal, state, and local laws and regulations and encourage other members of our industry to do the same.
- Educating clients as to the extent and kinds of services available.
- Asserting competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promoting the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 Quality System Documentation

The laboratory's Quality System is communicated through a variety of documents

- Quality Assurance Manual – Each laboratory has a lab-specific Quality Assurance Manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks, or forms associated with an operation of a management system, e.g., checklists, preformatted bench sheets, forms.
- Laboratory SOPs – General and technical
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QA Manual)
- Laboratory SOPs and Policies
- Other: Work Instructions (WI), memos, flow charts, etc.

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP

conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QA Manual shall take precedence over the CQMP in those cases.

Any regulatory requirements (e.g.; Ohio VAP, CT RCP, etc) provided in the laboratory specific documents (i.e., QA Manual and SOPs) take precedence over any policies provided in corporate documents.

5.4 QA/QC Objectives for the Measurement of Data

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives (DQOs) in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the DQOs specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory must provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity, and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) and/or matrix spike duplicate (MSD) samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet DQOs of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptable recovery centered on the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference (RPD) between separately procured, but otherwise identical, samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness, and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the same laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision, and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project) expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability must be defined in a QAPP, project scope, or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), inter-element corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc.

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit [MDL]) or quantified (Reporting Limit [RL]).

5.5 Criteria for Quality Indicators

The laboratory maintains Quality Control Limits in LIMS that summarize the precision and accuracy acceptability limits for performed analyses. These summaries include an effective date, are updated each time new limits are generated, and are managed by the laboratory's QA Department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where U.S. EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits are contained in NC-QA-018 Statistical Evaluation of Data and Development of Control Charts and in Section 24).

5.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Group Leader and QA Manager) and entered into LIMS. The Quality Assurance department maintains an archive of all limits used within the laboratory. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. If one or more QC values are outside of limits, the analyst then evaluates whether the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

The laboratory's procedures for the creation of control charts are described in laboratory SOP No. NC-QA-018, "Statistical Evaluation of Data and Development of Control Charts." Control charts are created from data stored in the LIMS. The charts are evaluated by QA and/or technical staff to determine if limits need to be updated or to assess the need for corrective actions to improve method performance.

Control charts are used to develop control limits, trouble-shoot analytical problems, and, in conjunction with the non-conformance system, to monitor for trends. Program-specific data analysis requirements for control charts are followed as required for data generated under those programs. These additional requirements shall be documented in a QAPP.

5.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6. DOCUMENT CONTROL

6.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled at each laboratory Facility:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Laboratory spreadsheets used for calibration and analysis
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers, and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the company intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP NC-QA-030, "Document Control" and SOP NC-QA-027, "Preparation and Management of SOPs.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. The laboratory also maintains instrument manuals (hard or electronic copies). These documents are maintained on the public drive in a document control master database.

The QA department maintains control of supporting records such as audit reports and responses, logbooks, standard logs, Ethics and QA training files, MDL studies, PT studies, certifications and related correspondence, and corrective action reports. Raw analytical data, consisting of bound logbooks, instrument printouts, any other notes, technical training files, magnetic media, electronic data, and final reports are retained electronically by each analytical section, the QA department, or on the company servers.

6.2 Document Approval and Issue

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, revision number, and the laboratory name and facility. The QA Department is responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department and members of management. In order to develop a new document, a staff member submits a draft to the QA Department for comments, changes, and approval before use. Upon approval, QA personnel add the

identifying version information to the document and retain that document as the official document on file. The document is then provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution (see SOP NC-QA-027 for more information).

The QA Department maintains a list of the official versions of controlled documents in the document control database.

Quality System Policies and Procedures must be reviewed at a minimum of every 24 months, and revised as appropriate. Some programs require annual review. Changes to documents occur when a procedural change warrants.

6.2 Procedures for Document Control Policy

For changes to the QA Manual, refer to SOPs NC-QA-019 and CW-Q-S-001. Uncontrolled copies must not be used within the laboratory. Previous revisions are stored electronically by the QA Department on the public server in the QAQC folder for the applicable revision. The current revision is located in the public controlled document folder accessible to all employees.

For changes to SOPs, refer to Corporate SOP CW-Q-S-002, Writing a Standard Operating Procedure (SOP), and SOP NC-QA-027, Preparation and Management of Standard Operating Procedures. The SOP identified above also defines the process of changes to SOPs.

Forms, worksheets, work instructions, electronic spreadsheets, logbooks, and information are identified and organized by the QA department in accordance with the procedures specified in laboratory SOPNC-QA-027.

6.3 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, hard copies of obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived in accordance with SOP NC-QA-027.

SECTION 7. SERVICE TO THE CLIENT

7.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for

adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, turnaround time, sensitivity (detection and reporting levels), accuracy, and precision requirements (Recovery [%R] and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel, and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time must be checked for feasibility.

Electronic or hard-copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this must be documented and discussed with the client prior to contract approval (refer to Section 8 for Subcontracting Procedures).

The laboratory informs the client of the results of the review and whether any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily is indicated. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 Review Sequence and Key Personnel

Appropriate personnel must review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the Client Relationship Manager or Proposal Team, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP CA-L-P-002, Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in this order):

- Contract Administrator
- VP of Operations
- Laboratory Project Manager
- Laboratory and/or Corporate Technical Director
- Laboratory and/or Corporate Information Technology Managers/Directors
- Account Executives Laboratory and/or Corporate Quality Assurance Managers
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote, and makes final acceptance for their facility.

The Sales Director, Contract Administrator, Account Executive, or Proposal Coordinator then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her backup will fulfill the review requirements.

The Contracts Department (or their designee) maintains copies of all signed contracts. The Laboratory Director also maintains an electronic copy of any contract signed at the local level.

7.3 Documentation

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes.

The contract must be distributed to and maintained by the Corporate Contracts Department and the applicable Account Executive. A copy of the contract must be filed electronically by the Laboratory Director. Quotes must be archived electronically in the laboratory quote module in TALs or in the public shared drive if an off-TALs quote is submitted.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps email records or a phone log of conversations with the client.

7.3.1 Project-Specific Quality Planning

Communication of contract-specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, the laboratory assigns a PM

to each client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes, e.g., use of a non-standard method or modification of a method, and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory. Project-specific changes made after samples are in-house are communicated through Change Information Notification emails
Programmatic and/or method changes are communicated via email transmittal and/or in meetings with the applicable Operations Managers. If the modification includes use of a non-standard method, or significant modification of a method, documentation of the modification is made in the case narrative of the applicable data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the

laboratory for the witnessing of tests performed for the client.

- Assist client-specified third-party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 Client Communication

Customer Service Managers (CSMs) and Project Managers (PMs) are the primary communication link to the clients. They must inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project Management must maintain ongoing client communication throughout the entire client project.

The Technical Director, Operation Manager, QA Manager or Group Leaders are available to discuss any technical questions or concerns the client may have.

7.6 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 Client Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service. TestAmerica Sales and Marketing teams periodically develop lab and client-specific surveys to assess client satisfaction.

SECTION 8. SUBCONTRACTING OF TESTS

8.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica Laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica Laboratories. The term "outsourcing" refers to the act of subcontracting tests. When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOPs on Subcontracting Procedures (CA-L-S-002) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory must assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI ISO/IEC 17025:2005(E) and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending

the samples to the subcontract facility. Additionally, work requiring accreditation must be placed with an appropriately accredited laboratory. In all cases, TNI accredited as well as non-TNI, the laboratory performing the subcontracted work must be identified in the final report.

PMs or Client Service Managers (CSM) or Account Executives (AE) (or others as defined by the lab) for the Export Lab (TestAmerica laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting samples to another laboratory) are responsible for obtaining client approval prior to outsourcing any samples. The laboratory must advise the client of a subcontract or work sharing arrangement in writing and, when possible, approval from the client must be retained in the project folder. Standard TestAmerica Terms & Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies (e.g., USDA) or contracts may require notification prior to placing such work.

8.2 Qualifying and Monitoring Subcontractors

Whenever a PM or CSM becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory
- Firms specified by the client for the task. (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder.)
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica. A listing of all approved subcontracting laboratories is available on the TestAmerica intranet site. Supporting documentation is maintained by Corporate offices and by the TestAmerica laboratory originally requesting approval of the subcontract lab. Verify necessary accreditation, where applicable (e.g., on the subcontractors TNI, A2LA accreditation, or State Certification).
- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses
- TNI or A2LA-accredited laboratories
- In addition, the firm must hold the appropriate certification to perform the work required

All TestAmerica Laboratories are pre-qualified for work sharing, provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. Refer to Corporate SOP CA-C-S-001, "Work Sharing Process."

8.2.1 When the potential subcontract laboratory has not been previously approved, CRMs or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the QA Manager begin the process of approving the subcontract laboratory as outlined in Corporate SOP CA-L-S-002, Subcontracting Procedures. Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to the Corporate Quality Information Manager (QIM) for review. Once all documents are reviewed for completeness, the Corporate QI Manager will forward the documents to the Purchasing Manager for formal signature and contractive with the laboratory. The approved vendor will be added to the subcontractor list on the intranet site, and the Finance Group is concurrently notified for J.D.Edwards.

8.2.2 The client must assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list, and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors must be monitored periodically by the Corporate Contracts and/or Quality Departments. Any problems identified must be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints must be investigated. Documentation of the complaint, investigation, and corrective action must be maintained in the subcontractor file on the intranet site. Complaints are posted using the Vendor Performance Report.

- Information must be updated on the intranet when new information is received from the subcontracted laboratories.

- Subcontractors in good standing must be retained on the intranet listing. CSO personnel must notify all TestAmerica laboratories, Corporate Quality, and Corporate Contracts if any laboratory requires removal from the intranet site. This notification must be posted on the intranet site and e-mailed to all CSO Personnel, Laboratory Directors, QA Managers, and Sales Personnel.

8.3 Oversight and Reporting

The CRM or PM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which reflect the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Legal & Contracts Director can tailor the document or assist with negotiations, if needed. The CRM or PM responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented within the project records. For TestAmerica Laboratories, certifications can be viewed on the company's TotalAccess Database.

The Shipping Department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must be available in TALS for all samples workshared within TestAmerica. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as non-TNI accredited work. If TNI accreditation is not required for the project, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratory EDD, i.e., imported, the report must explicitly indicate the specific lab that produced the data and identify the specific methods and samples.

Note: The results submitted by a TestAmerica work-sharing laboratory may be transferred electronically and the results reported by the TestAmerica work-sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 Contingency Planning

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs; however, this decision and justification must be documented in the project files, and the "Purchase Order Terms and Conditions for Subcontracted Laboratory Services" must be sent with the samples and Chain-of-Custody. In the event this provision is utilized, the laboratory (e.g., QA Manager) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time. The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

SECTION 9. PURCHASING SERVICES AND SUPPLIES

9.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet laboratory demand on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Corporate Controlled Purchases Procedure, SOP CW-F-S-007.

Contracts must be signed in accordance with TestAmerica's Corporate Authorization Matrix Policy, Policy CW-F-P-002. Request for Proposals (RFP's) must be issued when more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass must be used where possible. For safety purposes, thick-wall glassware must be used where available.

9.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment, consumables, and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent and Acid Lot Testing and Approval, SOP CA-Q-S-001. Approval information for the solvents and acids tested under SOP CA-Q-S-001 is stored on the TestAmerica SharePoint, under Solvent Approvals. A master list of all tested materials, as well as the certificates of analysis for the materials, is stored in the same location.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst may check the item out of the on-site consignment system that contains items approved for laboratory use. If the item is not in consignment, the analyst must provide the master item number, item description, package size, catalogue page number, and the quantity needed. If an item being

ordered is not the exact item requested, approval must be obtained from the Operations Manager or Group Leader prior to placing the order. The Canton purchasing manager places the order.

9.3.2 Receiving

It is the responsibility of the Warehouse Manager to receive the shipment. It is the responsibility of the analyst who ordered the materials to document the date materials were received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented.

Safety Data Sheets (SDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent. Specifications are listed in SOP NC-QA-017, Reagents and Standards.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory must contact the manufacturer to determine an expiration date.

The laboratory assumes a five-year expiration date on inorganic dry chemicals and solvents, unless noted otherwise by the manufacturer, or by the reference source method. Chemicals/solvents must not be used past the manufacturer's or SOP's expiration date unless "verified" (refer to Item 3 listed below).

- An expiration date cannot be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.
- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Method Blanks, LCS, etc.).

- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended six months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained in the Reagent module of LIMS for each laboratory group.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness, or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a conductivity of less than 1 µmho/cm (or specific resistivity of greater than 1.0 mega ohm/cm) at 25oC. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Operations Manager and appropriate Technical Manager must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottle ware used for sampling must be certified clean, and the certificates must be maintained. If uncertified sampling bottle ware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corporate Document CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 Purchase Of Equipment/Instruments/Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or group leader makes a supply request to the Operations Manager and/or the Laboratory Director. If they agree with the request the procedures outlined in TestAmerica's Corporate Policy CA-T-P-001, Qualified Products List, are followed. A

decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed, and Purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned, such as HP-20, and added to the equipment list that is maintained by the QA Department. IT must be notified so they can synchronize the instrument for backups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated followed by MDLs, Demonstration of Capabilities (DOCs) and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the bench. All equipment manuals are also recorded in the QA department document tracking system.

9.5 Services

Service to analytical instruments (except analytical balances) is performed on an as-needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Department Managers. The service providers that perform the services are approved by the Department Managers or Operations Manager.

Analytical balances are serviced and calibrated annually in accordance with SOP NC-QA-015. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. When the calibration certificates are received (usually within two weeks of the service), they are reviewed, and documentation of the review is filed with the certificates. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as thermometers, weight sets, autopipettors, etc., are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor's services, the vendor's accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory

9.6 Suppliers

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Procurement and Contracts Policy (Policy CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers /vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on

packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report. The Corporate Purchasing Group must work through the appropriate channels to gather the information required to clearly identify the problem and must contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports must be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department, Technical Services Director, and/or the Laboratory Director are consulted with vendor and product selection that have an impact on quality.

SECTION 10. COMPLAINTS

10.1 OVERVIEW

The laboratory considers an effective client complaint handling process to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and improving client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services, (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client,

outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following SOPs NC-QA-029, Nonconformance and Corrective Action System.

10.2 External Complaints

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to NC-QA-0029.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints must be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory must inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 Internal Complaints

Internal complaints include, but are not limited to errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and must follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing, and Information Technology (IT) may initiate a complaint by contacting the laboratory or through the Corrective Action system described in Section 12.

All audit findings (internal and external) will initiate the CA process, are documented with a CAR, and are tracked in the QA CA tracking workbook.

10.4 Management Review

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16)

SECTION 11. CONTROL OF NON-CONFORMING WORK

11.1 OVERVIEW

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies, and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a Corrective Action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the Corrective Action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's Corrective Action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it with the Technical Director or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratory's corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Operations Manager and QA Manager, documented and included in the project folder. Deviations must also be noted on the final report with a statement that the compound is not reported in compliance with TNI (or the analytical method) requirements and the reason. Data being reported to a non- TNI state would need to note the change made to how the method is normally run.

Note: The laboratory must implement Corrective Action procedures to resolve the deviation and limit qualification of the final results. The laboratory is not permitted to deviate from its VAP approved SOP if it intends to attest under affidavit that the "results" are VAP certified. When all Corrective Actions listed in the SOP have been exhausted, it may be necessary to use technical judgment in which case the decision process and rationale will be presented in the final report and/or affidavit and the data will be noted as 'not VAP certified' on the affidavit.

11.2 Responsibilities and Authorities

Under certain circumstances the Laboratory Director, Operations Manager, Technical Director, Project Manager, or a member of the QA team may exceptionally authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client must be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's Corrective Action procedures described in Section 12. This information may also need to be

documented in logbooks and/or data review as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24 hours. The Senior Management staff is compromised of the Laboratory Director, QA Manager, Operations Manager, and Technical Director. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, VP of Operations, and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 Evaluation of Significance and Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

Corporate SOP entitled Data Recalls (CW-Q-S-005) is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

Corporate SOP entitled Internal Investigations (CW-L-S-002) is the procedure to be followed for investigation and correction of situations involved alleged incidents of misconduct or violation of the company's ethics policy.

Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/Corrective Action reporting in lieu of the data recall determination form contained in TestAmerica Corporate CW-Q-S-005.

11.4 Prevention Of Nonconforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's Corrective Action system. Periodically, as defined by the laboratory's preventive action schedule (monthly), the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's Corrective Action process may be followed.

11.5 Method Suspension/Restriction (Stop Work Procedures)

In some cases it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality must be respected, and the problem with the required corrective and preventive action must be stated in writing and presented to the Laboratory Director.

The Laboratory Director must arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting must be held to confirm that there is a problem, that suspension/restriction of the method is required and must be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target, or test fully back on line.

The QA Manager must also initiate a Corrective Action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed-upon steps should be faxed or e-mailed by the laboratory to the appropriate VP of Operations and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the Internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction, i.e., Project Management, Log-in, etc. Clients must NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager must determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Director, QA Manager, Group Leader) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed Corrective Action report.

SECTION 12. CORRECTIVE ACTION

12.1 Overview

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the Corrective Action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Nonconformance Memos (NCM) are used to document excursions for SOPs, control limits, holding times, etc. A Corrective Action report is used to document and communicate actions taken to investigate, correct, and prevent recurrence of a more significant problem. All incidents are documented and tracked in the QA corrective action database. A brief summary of the system is described below, for more detail refer to SOP NC-QA-029.

12.2 General

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, PT performance, client complaints, staff observation, etc.

The purpose of a Corrective Action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution
- Improve systems and/or processes

12.2.1 Non-Conformance Memo (NCM) -

is used to document the following types of one-off corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client Complaints
- Discrepancies in materials / goods received vs. manufacturer packing slips

12.2.2 Corrective Action Report (CAR)-

is used to document the following types of investigations and resulting corrective actions:

- Questionable trends that are found in the review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and external audit findings
- Failed or unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic reporting / calculation errors
- Client complaints
- Data recall investigations
- Identified poor process or method performance trends
- Excessive revised reports

This will provide background documentation to enable root cause analysis and preventive action.

12.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a Corrective Action. There are four main components to a closed-loop Corrective Action process once an issue has been identified--Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue, and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment. SOP NC-QA-029, Nonconformance and Corrective Action System, establishes procedures for the identification and documentation of nonconformances and corrective actions and the steps taken to investigate and respond as a result of these events.

- The cause analysis step is the key to the process as a long-term corrective action cannot be determined until the root cause is determined.

- If the cause is not readily obvious, the Technical Manager, Laboratory Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory must identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.

- Corrective actions must be, to a degree, appropriate to the magnitude of the problem identified through the cause analysis.

- Whatever corrective action is determined to be appropriate, the laboratory must document and implement the changes. The NCM or CAR is used for this documentation. NCMs are tracked in the laboratory LIMS NCM module. Corrective Actions are tracked in the QA department CA tracking workbook and Incident/Correction Tracker System (iCAT).

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. Corporate SOP Root Cause Analysis (No. CA-Q-S-009) describes the procedure.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the Root Cause data from these incidents to identify root causes that, when corrected, can lead to dramatic improvements in performance

by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred five consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Group Leader, Technical Director and QA Manager are responsible to ensure the corrective action taken was effective.

- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. The Technical Director is accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.

- Each corrective action is recorded in the QA corrective action database for tracking to completion. Each NCM is recorded in TALS and available for tracking purposes and a summary report of all NCMs can be is reviewed to evaluate whether an on-going problem may exist by assessing trending.

- TestAmerica laboratories began using the Incident/Corrective Action Tracker (iCAT) database developed by the company in 2015. An incident is an event triggering the need for one or more corrective actions as distinct from a corrective action, a potential deficiency stemming from an incident that requires investigation and possibly fixing. The database is independent of TALS, available to all local and corporate managers, and capable of notifying and tracking multiple corrective actions per event, dates, and personnel. iCAT allows associated document upload, categorization (such as, external/internal audit, client service concerns, data quality issues, proficiency testing, etc.), and trend analysis. Refer to Figure 12-1.

- The QA Manager reviews monthly NCMs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.

- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and must be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or

federal requirements.

- -These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered. (Also refer to Section 15.2.4, Special Audits.)

12.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11 for information regarding the control of non-conforming work). The documentation of these procedures is through the use of an NCM.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs.

* For the Ohio EPA Voluntary Action Program (VAP), please refer to the SOPs for the acceptable criteria, corrective actions, and exceptions.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, Work Instructions, and QA Manual Sections 19 and 20. The QA Manager reviews all corrective actions monthly, at a minimum, and highlights are included in the QA monthly report.

To the extent possible, samples must be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data must be reported with an appropriate data qualifier and/or the deficiency must be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by a written NCM and appropriate corrective action (e.g., re-analysis) is taken and documented.

12.5 Basic Corrections

When mistakes occur in records, each mistake must be crossed-out with a single line [not obliterated (e.g. no White-Out)], and the correct value entered alongside. All such corrections must be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) must also be documented.

Table 12-1. Example – General Corrective Action Procedures

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Initial Instrument Blank *(Analyst)*	- Instrument response < RL. -See details in Method SOP	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..
Initial Calibration Standards *(Analyst, Group Leaders)*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Group Leaders*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewers)*	- % Recovery within limits documented in LIMS.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria the data for that sample shall be reported with qualifiers.
Laboratory Control Sample (LCS) *(Analyst, Data Reviewers)*	- % Recovery within limits specified in LIMS.	- -Check calculations and instrument performance - Re-analyze the LCS and if still outside of control limits, re-prepare and re-analyze all samples in the batch. It is acceptable to report data when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported. **Note:** If there is insufficient sample or the holding time cannot be met, contact the project manager for client instruction.

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Surrogates *(Analyst, Data Reviewers)*	- % Recovery within limits specified in LIMS.	-Reprep and analyze the QC batch for MB surrogates below control limits -Report data with narrative if the surrogate is biased high and associated samples are < RL
Method Blank (MB) *(Analyst, Data Reviewers)*	< Reporting Limit with the exception of Common Laboratory Contaminants listed in QA-003 QC Policy.	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is > 1/10 of the amount measured in the sample. -Results are acceptable if the same contaminants were not found in the associated samples.
Proficiency Testing (PT) Samples *(QA Department,, Analysts, Group Leaders)*	- Criteria supplied by PT Supplier.	- Any failures must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Department, Operations Manager, , Group Leaders, Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc..	- Non-conformances must be investigated system and necessary corrections must be made.

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Group Leaders, QA Manager, Corporate QA,)	SOP CW-Q-S-005, Data Recall	- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002 or your lab's CA SOP.
Client Complaints *(Project Managers, Lab Director, QA Department, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint.
QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director, *Group Leaders*)		- Corrective action is determined by the type of issue.
Health and Safety Violation (EH&S Coordinator, Lab Director, Operations Manager, Group Leaders)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated.

SECTION 13. PREVENTIVE ACTION / IMPROVEMENT

13.1 OVERVIEW

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action

process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and client satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:

- review of the monthly QA Metrics Report,
- trending NCMs,
- review of control charts and QC results,
- trending proficiency testing (PT) results,
- performance of management system reviews,
- trending client complaints,
- review of processing operations, or
- staff observations

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, Ethics training, etc. The metrics report is reviewed monthly by the laboratory management, Corporate QA and TestAmerica's Executive Committee. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.

- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action.
- Close-out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process, and management review.

13.1.2 Any Preventive Actions undertaken or attempted must be taken into account during the Annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of success and failure within the preventive action program is sufficient to provide management with a measurement for evaluation.

13.2 Management Of Change

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of changes covered under this system include: Facility Changes, Major Accreditation Changes, Addition or Deletion to Division's Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes. The laboratory has a graded approach for managing change based on the Management Systems Review.

SECTION 14. CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. Exceptions for programs with longer retention requirements are discussed in Section 14.1.2.

14.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the QA Department which is backed up as part of the regular network backup. Records are of two types--either electronic or hard-copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by the Records Manager.

Table 14-1. Records Index [1]

	Record Types [1]:	Retention Time:
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Policy Memorandums - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Responses - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	5 Years from archival* Data Investigation: 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documents - Contracts and Amendments - Correspondence - QAPP - SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Accounting	10 years
	EH&S Manual, Permits	7 years
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	Refer to HR Manual
	Administrative Policies Technical Training Records	7 years

1. *Record Types encompass hardcopy and electronic records.*
2. *Examples of logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).*

* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility that provides a suitable environment to prevent damage or deterioration and to prevent loss. All records must be protected against fire, theft, loss,

environmental deterioration, and vermin. In the case of electronic records and electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees, and shall be documented with an access log. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention must be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Note: For the Ohio VAP program the laboratory is required to notify Ohio EPA of its intent to dispose of any records.

Table 14-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Michigan Department of Environmental Quality – all environmental data	10 years
OSHA - 40 CFR Part 1910	30 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement and others as negotiated.
Ohio Voluntary Action Program	10 years and State contacted prior to disposal

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is

maintained as hardcopy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to Section 19.14.1 for more information.

14.1.4 The record-keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data. (Records stored off site should be accessible within two days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This must include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory copy of the Chain-of-Custody is stored with the invoice and the Work Order sheet generated by LIMS. The Chain-of-Custody would indicate the name of the sampler. If any sampling notes are provided with a Work Order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record-keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes, e.g., set format for naming electronic files, set format for what is included with a given analytical data set. SOP NC-QA-019, Records Information Management, outlines this procedure. Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; each day's run long or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, electronic spreadsheets are used to record and file data, or data is input directly into the LIMS. Standard and reagent information is entered into LIMS for each method as required.

- Changes to hardcopy records must follow the procedures outlined in Sections 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "Sampled by," "Prepared by," "Reviewed by", or "Analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink or entered directly into LIMS at the time the data is generated..

- Hard-copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure no data is lost, and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard-copy which was scanned.

- Also refer to Section 19.14.1, "Computer and Electronic Data Related Requirements".

14.2 Technical And Analytical Records

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement (refer to Section 15.1). The records for each analysis must contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records must include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing results.

14.2.2 Observations, data, and calculations are recorded in real-time at the time they are made and are identifiable to the specific task.

14.2.3 Changes to hardcopy records must follow the procedures outlined in Sections 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- Laboratory sample ID code
- Date of analysis. Time of analysis is also required if the holding time is 72 hours or less, or when time-critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available. Instrument logs may be in electronic format.
- Analysis type;
- All manual calculations and manual integrations
- Analyst or operator initials/signature
- Sample preparation, including cleanup, separation protocols, incubation periods, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents
- Test results
- Standard and reagent origin, ID codes, and dates of receipt, preparation, and use
- Calibration criteria, frequency, and acceptance criteria
- Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions

- Quality control protocols and assessment
- Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats.

14.2.4 All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a documented supervisory or peer review on a monthly basis.

14.3 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- All original raw data, whether hard-copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records)
- A written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value
- Copies of final reports
- Archived SOPs
- Correspondence relating to laboratory activities for a specific project
- All Corrective Action reports, audits and audit responses
- Proficiency test results and raw data
- Results of data review, verification, and cross-checking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include, but are not limited to, records pertaining to:

- Sample preservation including appropriateness of sample container and compliance with holding time requirement
- Sample identification, receipt, acceptance or rejection and login
- Sample storage and tracking including shipping receipts, sample transmittal / COC forms

- Procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard-copy form Refer to Table 14-1.

14.5 Records Management, Storage, And Disposal

All records (including those pertaining to test equipment), certificates, and reports are safely stored, held secure, and in confidence to the client. Certification-related records are available to the accrediting body upon request.

All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

Records that are stored or generated by computers or personal computers have hardcopy, write-protected backup copies, or an electronic audit trail controlling access.

The laboratory has a record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage, and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. Standards are maintained in the LIMS – no logbooks are used to record that data. Records are considered archived when noted as such in the records management system (a.k.a., document control.)

14.5.1 Transfer Of Ownership

In the event the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous five years of such action.

14.5.2 Records Disposal

Records are removed from the archive and destroyed after five years, unless otherwise specified by a client or regulatory requirement. On a project-specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration (refer to Tables 14-1 and 14-2).

Electronic copies of records must be destroyed by erasure or physically damaging off-line

storage media so no records can be read.

If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15 AUDITS

15.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in TestAmerica Corporate SOP CW-Q-S-003 on performing Internal Auditing. The types and frequency of routine internal audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or Corporate QA	All areas of the laboratory annually
Method Audits QA Technical Audits	Joint responsibility: a). QA Manager or designee b). Technical Director or designee (refer to CW-Q-S-003)	QA Technical Audits Frequency: 50% of methods annually
SOP Method Compliance	Joint responsibility: a).QA Manager or Designee b).Technical Manager or Designee (Refer to CW-Q-S-003)	SOP Compliance Review Frequency Every 2 years
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits
Performance Testing	Analysts with QA oversight	Two successful per year for each TNI field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to, data review, quality controls, preventive action, and corrective action. The completeness of earlier corrective action is assessed for effectiveness and sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

Note: Part of the quality systems audit relates to regulatory compliance. An assessment of the laboratory's compliance to regulatory requirements is performed by Corporate QA through monthly management reports, review of client and regulatory concerns, and also through periodic on-site evaluations.

15.1.2 QA Technical Audits

QA technical audits assess data authenticity and analyst integrity. These audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit Miner programs (e.g., Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits must include all methods within a two-year period. All analysts should be reviewed over the course of a two year period through at least one QA Technical Audit

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs must be assessed by the Technical Director or qualified designee at least every two years. The work of each newly hired analyst is assessed within three months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products must be performed within three months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue. Special audits will also be performed when new methods and/or instrumentation is implemented.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies—non potable water and soil.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 External Audits

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory group leaders are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the laboratory's Corrective Action plan must be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found within the 2009 TNI standards.

15.3 Audit Findings

Audit findings are documented using the Corrective Action process and database. The laboratory's Corrective Action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by Operations management and the QA Manager.

Developing and implementing Corrective Action to findings is the responsibility of the Group Leader where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. When requested, a copy of the audit report and the laboratory's Corrective Action plan must be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory must take timely corrective action, and must notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24 hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16. MANAGEMENT REVIEWS

16.1 Quality Assurance Report

A comprehensive QA Report must be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director and Corporate Quality Director, as well as the VP of Operations. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, VP of Operations, or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and VPs of Operations.

16.2 Annual Management Review

The Senior Lab Management Team (Laboratory Director, Technical Director, Operations Manager, QA Manager, PM Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, objectives, and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel may be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory must summarize any critical findings that cannot be solved by the lab, and report them to Corporate IT.

The Management Systems Review (Corporate SOP CW-Q-S-004 and Work Instruction CW-Q-WI-003) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and

effective; therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review
- Prior Monthly QA Reports issues
- Laboratory QA Metrics
- Review of report reissue requests
- Review of client feedback and complaints
- Issues arising from any prior management or staff meetings
- Minutes from prior Senior Lab Management Team meetings; Issues that may be raised from these meetings include:
    - Adequacy of staff, equipment and facility resources
    - Adequacy of policies and procedures
    - Future plans for resources and testing capability and capacity
- The annual internal double blind PT program sample performance (if performed)
- Compliance to the Ethics Policy and Data Integrity Plan, including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate VP of Operations, and Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants
- A reference to the existing data quality related documents and topics that were reviewed
- Quality system or operational changes or improvements that will be made as a result of the review, e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)

Changes to the quality systems requiring update to the laboratory QA Manual must be included in the next revision of the QA Manual.

16.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Internal Investigations SOP CW-L-S-002 must be followed. All investigations that result in finding inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's President and CEO, Executive VP of Operations, VP of Client & Technical Services, VPs of Operations and Quality Directors receive a monthly report from the VP-

QA/EHS summarizing any current data integrity or data recall investigations. The VPs of Operations are also made aware of progress on these issues for their specific labs.

SECTION 17. PERSONNEL

17.1 Overview

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training must have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff must be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training must be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance with the laboratory's quality system.

17.2 Education and Experience Requirements for Technical Personnel

The laboratory makes every effort to hire analytical staff that posses a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. There are competent analysts and technicians in the industry who have not earned a college degree. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet "Human Resources" web-page (also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance or quantitation techniques, etc. are also considered).

As a general rule for analytical staff:

Table 17-1 Personnel Education and Experience

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least one year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	Or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience. Or 5 years of prior analytical experience
Group Leaders – General	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Group Leader, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions until DOC requirements are met..

17.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Table 17-2 Required Training

Required Training	Time Frame*	Employee Type
New Hire Orientation	Immediately	All
Environmental Health & Safety Orientation	Prior to lab work	All
Environmental Health & Safety Orientation Follow-up Test	30-60 days after hire	All
Environmental Health & Safety Training	Refer to EH&S Manual	All
Ethics – New Hires	1 week of hire	All
Ethics - Comprehensive	90 days of hire	All
Data Integrity	90 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual, and SOPs, and any work instructions involving their area of responsibility. This documentation is updated as the various documents are revised.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in the employee's training file.

- Documentation of proficiency (refer to Section 19)
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training
- A Confidentiality Agreement signed by each staff member at the time of employment
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct, e.g., ethics. This information is maintained in the employee's secured personnel file.

Evidence of successful training could include such items as:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analysts' knowledge of the QA Manual for quality issues
- Analysts following SOPs, i.e., practice matches SOPs
- Analysts regularly communicate to group leaders and QA if SOPs need revision rather than waiting for auditors to find problems.

Further details of the laboratory's analyst training program are described in the Laboratory Training SOP NC-QA-028, Employee Orientation and Training.

17.4 Data Integrity And Ethics Training Program

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within one week of hire followed by technical data integrity training within 90 days, comprehensive training within 90 days, and annual refresher for all employees. Senior management at each facility performs the Ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times, TestAmerica has established a Corporate Ethics Policy (CW-L-P-004) and an Ethics Statement. All initial and annual training is documented by employee signature on the signed Ethics Statement/Agreement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts; for that reason, TestAmerica has a zero tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting
- Ethics Policy

- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping
- Discussion regarding data integrity procedures
- Specific examples of breaches of ethical behavior--peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion
- Internal monitoring. Investigations and data recalls
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient

Additionally, a Data Integrity Hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18. ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 Overview

The laboratory is a 54,440 sq. ft. secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc. OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity-controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

18.2 Environment

Laboratory accommodation, test areas, energy sources, and lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air

conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory. A 225KVA UPS is installed in the main electrical bus to provide at least 15 minutes of backup power in the event of a power failure. This unit also provides voltage and frequency control of lab and office power. A spike/surge arrestor is installed to protect against power surge/sag and lightning strikes. A 30 KW natural gas-fueled backup generator is installed to provide power to the I.T. area in the event of a power failure. Additionally, this generator provides power to two walk-in sample storage coolers and several other smaller sample storage coolers. Smaller portable generators are available to provide "spot power" where needed in the event of a power failure.

When any of the method or regulatory required environmental conditions change to an extent that they may adversely affect test results, analytical testing must be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the offsite facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Access to, and use of, all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

- Access and entryways to the laboratory
- Sample receipt areas
- Sample storage areas
- Chemical and waste storage areas
- Data handling and storage areas
- Sample processing areas

- Sample analysis areas

18.4 Floor Plan

A floor plan can be found in Appendix 1.

18.5 Building Security

Building keys and keybadges are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the visitor is provided with any necessary personal protection equipment. The Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.

Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

Signs are posted in the laboratory designating employee only areas - "Authorized employees beyond this point".

SECTION 19. TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage, and preparation of samples; and, where appropriate, an estimation of the measurement of uncertainty, as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPs)

The laboratory maintains SOPs that accurately reflect all of the laboratory procedures such as assessing data integrity, taking corrective action, handling customer complaints, as well as all analytical methods and sampling procedures. The method SOPs are derived from promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.

- Procedures for writing an SOP are included in TestAmerica's Corporate SOP CW-Q-S-002 entitled Writing a Standard Operating Procedure, or the Canton laboratory SOP NC-QA-027, Preparation and Management of Standard Operating Procedures.

- SOPs are reviewed at a minimum of every two years and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory must have available the published referenced method(s) as well as the laboratory developed SOP(s).

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory must demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index/Listing for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services, e.g., special matrices, non-routine compound lists, etc., the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods must be used.

When clients do not specify the method to be used or specific methods are not available, the methods that are used must be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM); Non-polar Material) by Extraction and Gravimetry, EPA-821-R-98-002, February 1999
- Method 1630, Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap and CVAFS, August, 1998.
- Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, EPA-821-R-02-19, August 2002.
- Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)
- Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983
- Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.
- Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.
- Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th edition/ on-line edition Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.
- Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996, Final Update IV, January 2008, Final Update V, August 2015.
- Modified DRO, Method for Determining Diesel Range Organics, Wisconsin DNR, PUBL-SW-141, September 1995.
- Modified GRO, Method for Determining Gasoline Range Organics, Wisconsin DNR, PUBL-SW-140, September 1995.
- Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA
- Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, client requirements, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory must inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it must be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory must confirm that it can properly perform the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix.

A demonstration of capability is performed (SOP NC-QA-028, Employee Orientation and Training) whenever there is a change in instrument type (e.g., new instrumentation), method, or personnel (e.g., analyst has not performed the test within the last 12 months).

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

The initial demonstration of capability (IDOC) must be thoroughly documented and approved by the department group leader and QA Manager or designee prior to an analyst independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures for analyst training documentation.

Before the laboratory can analyze client samples by an analytical method, there must be an approved SOP in place, a demonstration of satisfactory analyst performance must be completed, and an MDL study (where applicable) must be performed. There may be other additional requirements stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Analyst IDOC/CDOC).

If the client states that the information is not for regulatory purposes, and is intended to screen for the presence of the analyte the result may be reported as long as the following criteria are met:

- A low-level standard containing the non-routine analyte at the RL must be analyzed to verify the laboratory's (and method) capability to detect the analyte at the RL.

If the client states that a quantitative result is required, a multi-point calibration must be analyzed, and ICV/CCV criteria must be met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).

- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve (low standard at or below the QL)and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL)Note: For Ohio VAP work, the term Reporting Limit will be used.

- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted as "Reporting Limit based on the low standard of the calibration curve".

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

At least four aliquots must be prepared (including any applicable clean-up procedures) in the same fashion, and following all of the same procedures, as client samples, and analyzed according to the test method (either concurrently or over a period of days).

Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest. Refer to SOP NC-QA-028, Employee Orientation and Training, for details on this procedure.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (see Figure 19-1 as an example) must be used to document the completion of each IDOC. A copy of the certification is archived in the analyst's training folder.

19.5 Laboratory-Developed Methods And Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must agree to the use of the non-standard method.

19.6 Validation of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are suitable for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices. In some cases, to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Limit of Quantitation (LOQ)

An important characteristic of expression of sensitivity is the difference in the LOD and the LOQ. The LOD is the minimum level at which the presence of an analyte can be reliably determined. The LOQ is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and accuracy. For most instrumental measurement systems, there is a region where estimated is generated around the LOD (both above and below the estimated MDL or LOD) and below the LOQ. In this range, detection of an analyte may be confirmed, but quantification of the analyte is unreliable with unknown accuracy and precision. When an analyte is detected below the LOQ, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the presence of the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data are to be reported in this range, it must be done so with a qualification that denotes the estimated/uncertain nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or LOQ cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of precision and accuracy.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment or Amendment, describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch-specific QC samples such as LCS, method blanks, or PT samples.

19.7 Method Detection Limits (MDL)/ Limits Of Detection (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B, or alternatively by other technically valid practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value can be differentiated from blanks. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. To allow for some flexibility, this low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used.

Refer to the Corporate SOP CA-Q-S-006 or the laboratory's SOP NC-QA-021 for details on the laboratory MDL process.

Note: For Ohio VAP projects, the MDL procedure must also comply with OAC Rule 3745-300-01(A)(78).

19.8 Instrument Detection Limits (IDL)

The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in the demonstration of instrument performance in other areas.

IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either by using seven replicate spike analyses, like MDL but without sample preparation, or by the analysis of ten instrument blanks and calculating three times the absolute value of the standard deviation.

If IDL is > than the MDL, it may be used as the reported MDL.

19.9 Verification of Detection and Reporting Limits

Once the MDL is determined, it must be verified on each instrument used for the given method by analyzing a quality control sample (prepared as a sample) at approximately 2-4 times the calculated MDL for each analyte. The analyte must be qualitatively identified.MDL and MDLV standards are extracted/digested and analyzed through the entire analytical process. The MDL and MDLV determinations do not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDLV standard is not successful, then the laboratory will review their MDL or extract and/or analyze another MDLV at a higher concentration. Refer to the laboratory SOP NC-QA-021 or Corporate CA-Q-S-006 for further details.

19.10 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept in each department. Complete details are available in the laboratory SOPs.

19.11 Evaluation Of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, atomic absorption, or fluorescence profiles.

19.12 Estimation Of Uncertainty Of Measurement

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurement" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty," the range within which the value of the measurement is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory within a specified concentration range can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty

range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 ± 0.5 mg/l.

19.12.5 In the case where a well-recognized test method specifies limits to the values of major sources of uncertainty of measurement, e.g., 524.2, 525, etc., and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample non-homogeneity, analyte precipitation or other loss over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.

- Homogenous samples: If a re-analysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within ± 1 reporting limit for samples < 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the re-analysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation, if sufficient sample is available. The three results are then compared to determine the most reliable/usable result(s).

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Group leader, if unsure.

19.14 Control Of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. The laboratory is currently running the TALS LIMS which is an in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS

for the remainder of this section. The LIMS utilizes Microsoft SQL, which is a relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity

Assurance is made that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.

- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.

- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails, and controlled access.

19.14.1.2 Ensure Information Availability

Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 Maintain Confidentiality

Data confidentiality is ensured through physical access controls, such as password protection or website access approval, when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved, e.g., extractions, dilutions, instrument readings, and concentrations. The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., General Chemistry, the data is reduced by the analyst and then verified by peer review once uploaded into LIMS. The review checklists are signed by both the analyst and reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP CA-Q-S-002, Acceptable Manual Integration Practices.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's specification; otherwise, it must not be performed. Calculations are independently verified by appropriate

laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). The person who performed each task (if multiple people were involved) in the preparation and analysis must be easily identifiable in the documentation.

19.14.2.2 In general, analyte results are reported in milligrams per liter (mg/L) or micrograms per liter (µg/L) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. The units "mg/L" and "mg/kg" are the same as "parts per million (ppm)". The units "µg/L" and "µg/kg" are the same as "parts per billion (ppb)." For values greater than 10,000 mg/L, results may be reported in percent, i.e., 10,000 mg/l = 1%. Units appropriate for us are defined in each laboratory SOP.

19.14.2.3 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.4 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or unconfirmed compounds. The analyst reviews what has been entered into LIMS to check for errors.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out in 'real time' and have enough information on them to trace the events of the applicable analysis/task (e.g., calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, traceable calculations, etc.). Logbooks and worksheets can also be in electronic format.

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA Department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the QA Department at the facility. The QA Department controls all worksheets following the procedures in Section 6.

19.14.4 Review/ Verification Procedures

Review procedures are outlined in several SOPs to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has an SOP discussing Manual Integrations to

ensure the authenticity of the data. The general review concepts are discussed below, more specific information can be found in the SOPs.

Data review procedures comprise a set of computerized and manual checks applied at appropriate levels of the measurement process. Data review begins with the reduction or processing of data and continues through verification of the data and the reporting of analytical results. Calculations are checked from the raw data to the final value prior to reporting results for each group of samples. Data reduction can be performed by the analyst who obtained the data or by another analyst. Data verification starts with the analyst who performs a 100% review of the data to ensure the work was done correctly the first time. Data verification continues with review by a second reviewer who verifies that data reduction has been correctly performed and that the analytical results correspond to the data acquired and processed.

19.14.4.1 Log-In Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.14.4.2 First Level Data Review - The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day's analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day's analytical run, evaluation of QC data, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented.

Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors

- Results outside of calibration range

19.14.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Director/Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.5 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.6 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, verifying that the COC is followed, cover letters / narratives are present, flags are appropriate, and project specific requirements are met. The Project Manager may also evaluate the validity of results for different test methods given expected chemical relationships.

19.14.4.7 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. When complete, the report is sent out to the client.

19.14.4.8 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods, and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP (CA-Q-S-002).

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved, or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts must not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate-approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1. Example - Demonstration of Capability Documentation

GC Analyst Demonstration of Capability

TestAmerica Canton

Analyst:

DOC Run Date:

Preparation Method(s):

8151 Herbicide SOP: NC-GC-038	WI DRO SOP: NC-GC-013	8315 Formaldehyde SOP: NC-GC-035	WI GRO Prep/Analysis SOP: NC-GC-031	8082/608 PCBs SOP: NC-GC-007/NC-GC-038
8081/608 Pesticides SOP: NC-GC-038	8015 DRO SOP NC-GC-043	8015 GRO Prep/Analysis SOP: NC-GC-025	Aromatic Acids Analysis (solid and water), solid prep SOP: NC-GC-036	RSK-175 SOP: NC-GC-032
1630 MeHg Prep/Analysis SOP: NC-GC-039	8011 Prep/Analysis SOP: NC-GC-040			

Matrix: □Water □Solid

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method with the specifications in the cited SOP, which is in use at the facility for the analysis of samples under the laboratory's Quality Assurance Plan, has completed the Demonstration of Capability (DOC).

2. The test method(s) was performed by the analyst identified on this certificate.

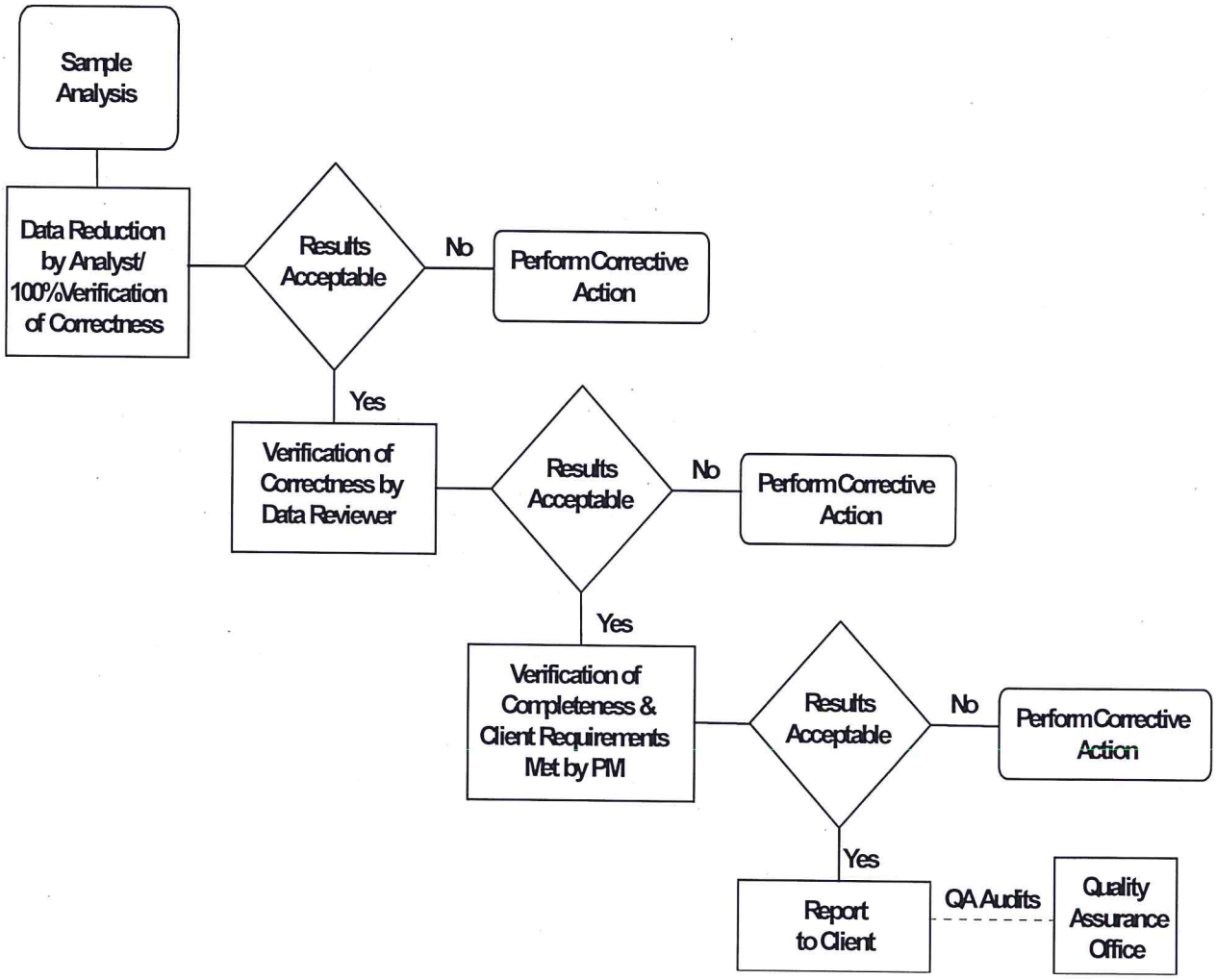
3. The data associated with the demonstration of capability are true, accurate, complete, and self-explanatory.

4. All raw data to reconstruct and validate these analyses have been retained at the facility.

5. The associated information is organized and available for review.

Department Supervisor	Signature	Date
Quality Assurance Officer	Signature	Date

Figure 19-2. Work Flow



SECTION 20 . EQUIPMENT AND CALIBRATIONS

20.1 Overview

The laboratory purchases technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency, and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to ensure that it meets its intended requirements. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory equipment and instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturers' instructions for equipment use are readily accessible to all appropriate laboratory personnel on the laboratory intranet.

20.2 Preventive Maintenance

The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

Routine preventive maintenance procedures and frequency, such as lubrication, cleaning, and replacements, are performed according to the procedures outlined in the manufacturer's manual. Qualified personnel also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Group Leader to ensure instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures are also outlined in analytical SOPs or instrument manuals. (Note: For some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear which instrument is associated with an entry.)

Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs must be kept for all major pieces of equipment. Instrument Maintenance Logbooks may also be used to specify instrument parameters.

- Documentation must include all major maintenance activities such as contracted preventive maintenance and service, upgrades, and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning, and adjustments.

- Each entry in the instrument log includes the Analyst's initials, date, a detailed description of

the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control, e.g., CCV run on 'date' was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records. A return to service date must be documented in the logbook.

- When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled-in page must be signed across the page entered and the logbook, so it is clear that a page is missing if only half a signature is found in the logbook. At a minimum, if an instrument is sent out for service or transferred to another facility it must be recalibrated upon installation and the laboratory MDL must be verified (using an MDLV) prior to return to laboratory operation.

If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has been shown to be defective or outside of specified limits) it must be taken out of operation and tagged as out of service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory must examine whether this defect had any effect on previous analyses.

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor, manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Backup instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the backup is not available and the analysis cannot be carried out within the needed timeframe, the samples must be subcontracted.

If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, dispensing devices, if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document method performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM Type 1 weights spanning its range of use (weights that have been calibrated to ASTM Type 1 weights may also be used for daily verification). ASTM Type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually

and if no damage is observed, they are calibrated at least every five years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains "calibration only" ASTM Type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards and the error term inherent in the calibration.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. Reference SOP NC-QA-015, Equipment Monitoring and Thermometer Calibration. A list of balances is in Table 21.2.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate that the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH, Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer.

- If the temperature measuring device is used over a range of 10°C or less, then a single point verification within the range of use is acceptable;
- If the temperature measuring device is used over a range of greater than 10°C, then the verification must bracket the range of use.

IR thermometers, digital probes, and thermocouples, are calibrated quarterly. IR Thermometers should be calibrated over the full range of use, including ambient, and iced (4 degrees). The digital NIST thermometer is recalibrated every year by an approved outside service and the provided certificate of traceability is kept on file. The digital NIST thermometer(s) have increments of 0.01 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logsheets. Monitoring of method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logsheets. More information on this subject can be found in SOP NC-QA-015, Equipment Monitoring and Thermometer Calibration.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept at 4 ± 2°C.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logsheets posted on each unit or saved electronically if an electronic monitoring system (such as Temp Guard) is used.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A glassware) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis. Glass microliter syringes are calibrated every 6 months after the first six months of use.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an "Accuracy and Precision Statement of Conformance" from Hamilton attesting established accuracy and considers the statement valid for the first six months..

The laboratory maintains a sufficient inventory of autopipettors, and dilutors of differing capacities that fulfill all method requirements.

These devices are given unique identification numbers, and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis.

Any device not regularly verified cannot be used for any quantitative measurements.

20.3.6 Field Sampling Devices (ISCO Autosamplers)

Each autosampler (ISCO) is assigned a unique identification number in order to keep track of the calibration. This number is recorded on the sampling documentation in a logbook.

The autosampler is calibrated semi-annually by setting the sample volume to 100ml and recording the volume received. The results are filed in a logbook/binder. The autosampler is programmed to run three cycles, and each of the three cycles is measured into a beaker to verify 100 ml are received.

If the RSD (Relative Standard Deviation) between the three cycles is greater than 20%, the procedure is repeated. If the result is still greater than 20%, the following options may be employed:

- The unit is taken out of service.

- The unit is used to pull composite samples only over a 24-hour period.
- The results of this check are kept in a logbook/binder.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method, or program.

If the initial calibration results are outside of the acceptance criteria, action is performed and any affected samples are re-analyzed, if possible. If re-analysis is not possible, any data associated with an unacceptable initial calibration must be reported with appropriate data qualifiers (refer to Section 12). All sample analyses reported for Ohio VAP certified data must be associated with a valid calibration.

Note: Instruments are calibrated initially and as needed after that and at least annually.

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of three calibration points will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). ICP and ICPMS methods which define the working range with periodic linear dynamic range studies, rather than through

the range of concentrations of daily calibration standards. All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations where no other source or lot is available, a standard made by a different analyst would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1. Calibration Verification

The calibration relationship established during the initial calibration must be verified initially (with a second source ICV) and at least daily (with a CCV) as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI Standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i.e., RPD, per 2009 TNI Standard EL-V1M4 Section 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used, then bracketing standards are not required. Only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12 hours of the beginning of the shift.

A continuing calibration verification (CCV) standard must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements (see specific SOPs). Most Inorganic methods require the CCV to be analyzed after ever 10 samples or injections including matrix or batch QC samples.

Note: If an internal standard calibration is being used, then bracketing standards are not required. Only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed and documented, the laboratory may demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with unacceptable calibration verification may be fully useable under the following special conditions and reported based upon discussion and approval of the client.

a). when acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise, the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated, and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated, and accepted.

Samples reported by the two conditions identified above will be appropriately flagged.

20.4.1.2. Verification of Linear and Non-Linear Calibrations

Calibration verification for linear calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit. For Ohio VAP samples, results may not be reported when calibration verifications fail the lower limit criterion.

20.5 Tentatively Identified Compounds (TICs) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. TICs cannot be reported as "VAP certified" data for Ohio VAP projects.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS Tuning

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Laboratory Equipment and Instrumentation

Note: *Laboratory equipment, model numbers, and serial numbers are subject to change without notice.*

Equipment Instrument	Manufacturer	Model Number	Serial Number	Year in Service
GC/MS VOA UX2 (screen)	Hewlett Packard	5971A-5890	S/N US00029070	1992
GC/MS VOA HP6 (screen)	Hewlett Packard	5973-6890	S/N US00005571	1998

Equipment Instrument	Manufacturer	Model Number	Serial Number	Year in Service
GC/MS VOA UX7 (screen)	Hewlett Packard	5973-6890	S/N US00010937	1998
GC/MS VOA UX8	Hewlett Packard	5973-6890	S/N US00027773	1999
GC/MS VOA UX9	Hewlett Packard	5973-3890	S/N US00028329	2000
GC/MS VOA UX10	Hewlett Packard	5973-6890	S/N US00032072	2000
GC/MS VOA UX11	Agilent	5973-6890	S/N US00038093	2000
GC/MS VOA UX12	Agilent	5973-6890	S/N US10202133	2002
GC/MS VOA UX14	Agilent	5973-6890	S/N CN10340027	2003
GC/MS VOA UX15	Agilent	5973-6890	S/N CN10515062	2005
GC/MS VOA UX16	Agilent	5973-6890	S/N CN10539065	2005
GC/MS VOA UX17	Agilent	5975-7890	S/N US10831043	2012
GC/MS VOA UX18	Agilent	5973-6890	S/N US00020913	2013
GC/MS SVOA HP7	Hewlett-Packard	5973-6890	S/N US71190756-US00009247	1998
GC/MS SVOA HP9	Hewlett-Packard	5973-6890	S/N US91422379-US72020889	2000
GC/MS SVOA HP10	Agilent	5973-6890	S/N US33220074-CN10340002	2003
GC/MS SVOA A4AG2	Agilent	5975C-7890	S/N US71235692-CN10721110	2007
GC A	Agilent	6890 FID	S/N US10402056	2004
GC O	Hewlett Packard	6890 FID	S/N US00007206	1997
GC Y	Hewlett Packard	6890 FID	S/N US10337062	2003
GC Z	Agilent	6890 EPC & PDD/FID	S/N 10205072	2000
GC P1	Hewlett Packard	6890 EPC & Dual ECD Y-Splitter	S/N US00023208	1998
GC P1		Sampler	US83401589	1998
GC P1		Tower	CN14422923	1998
GC P2 (Screening only)	Hewlett Packard	6890 EPC & Dual ECD Y-Splitter	S/N US00023512	1998
GC P2		Sampler	US93806108	1998
GC P2		Tower	US83602262	1998
GC P3	Hewlett Packard	6890 EPC & Dual ECD Y-Splitter	S/N US00023674	1998
GC P3		Sampler	US92205419	1998

Equipment Instrument	Manufacturer	Model Number	Serial Number	Year in Service
GC P3		Tower	CN42637504	1998
GC P4	Hewlett Packard	6890 EPC & Dual ECD Y-Splitter	S/N US00029531	1999
GC P4		Sampler	CN51232596	1999
GC P4		Tower	US82401457	1999
GC P5	Hewlett Packard	6890 EPC & Dual ECD Y-Splitter	S/N US00029508	2010
GC P5		Sampler	CN33826455	2010
GC P5		Tower	US92407745	2010
GC P6	Hewlett Packard	6890 EPC & Dual ECD Y-Splitter	S/N US00032848	2000
GC P6		Sampler	CN43130187	2000
GC P6		Tower	US91907177	2000
GC P9 (screening only)	Agilent	6890 EPC & Dual ECD Y-Splitter	S/N US10205045	2005
GC P9		Sampler	US01708111	2005
GC P9		Tower	US93408793	2005
GC P10	Agilent	6890 EPC & Dual ECD Y-Splitter	S/N US10151110	1999
GC P10		Sampler	CN14920067	1999
GC P10		Tower	US83802337	1999
GC P11	Agilent	6890N EPC & Dual ECD Y-Splitter	S/N CN10517088	2004
GC P11		Sampler	CN50432009	2004
GC P11		Tower	CN43220356	2004
GC P12	Agilent	6890N EPC & Dual ECD Y-Splitter	S/N CN10512025	2005
GC P12		Sampler	US90303085	2005
GC P12		Tower	CN51124095	2005
GC P13	Agilent	6890N EPC & Dual ECD Y-Splitter	S/N CN10435032	2004
GC P13		Sampler	CN42429315	2004
GC P13		Tower	CN14523156	2004
GC P14	Agilent	7890 EPC & Dual ECD Y-Splitter	S/N CN10281044	2012
GC P14		Sampler	CN10220022	2012
GC P14		Tower - front	CN10290167	2012
GC P14		Tower - rear	CN10290169	2012
GC P15	Agilent	6890N EPC & Dual ECD Y-Splitter	S/N CN10427010	2012
GC P15		Sampler	US11911568	2012
GC P15		Tower	CN43220375	2012
GC P16	Agilent	6890 EPC & Dual ECD Y-Splitter	S/N US00025858	2014
GC P16		Sampler	US83001373	2014
GC P16		Tower	CN14422847	2014
GC P18	Agilent	6890 EPC & Dual ECD Y-Splitter	S/N US00006438	2015
GC P18		Sampler	US93806073	2015

Equipment Instrument	Manufacturer	Model Number	Serial Number	Year in Service
GC P18		Tower	CN53827833	2015
GC HPLC L2	Agilent	HPLC 1100	S/N US82404153	1998
GC M	Tekran	Tekran 2700	S/N 25	2012
GC N	Agilent	7890 Atomic Fluorescence	S/N CN10820009	2008
Metals I-12	Thermo	Trace Analyzer 6500 Duo Ash	S/N ICP-20101711	2013
Metals I-9	Thermo	Trace Analyzer 6500 Duo Ash	S/N ICP 20102403	2010
Metals I-11	Thermo	X Series	S/N 01952C	2013
Metals I-10	Agilent	7700 ICPMS Series	S/N JP124521145	2013
Metals H1	Leeman	PS200 II	S/N HG9031	1999
Metals H4	Leeman	Hydra AA	S/N HA-6011	2006
Metals H6	Leeman	Hydra II AF Gold	S/N 64264	2011
Metals H7	Leeman	Hydra II AF Gold	S/N 64547	2012
Autotitrator (Steve)	Mantech	PC-Titrate	S/N MS-9K8-217	2001
BOD (Bugsy)	Mantech	PC-1085-00	S/N MT-113-207	2013
Discrete Analyzer (Barney)	Konelab	Konelab 200	S/N Z1718383	2001
Discrete Analyzer (Sauron)	Konelab	Konelab 250	S/N A2120021	2005
IC (Simon)	Dionex	DX-120	S/N 98110093	1999
EOX (Brian)	Thermo Electron	1200	S/N 2005.0234	2005
Spec (Bert)	Genesys	Spectronic 20	S/N 3SGL078016	1998
Spec (Ernie)	Genesys	Spectronic 20	S/N 3SGL226006	2008
IC (Veronica)	Dionex	ICS 2100	S/N 12031443	2012
IC (Cecilia)	Dionex	ICS 1500	S/N 03100737	2014
Discrete Analyzer (Maggie)	Systea	Easy Chem Plus	S/N 07004	2013
TOC (Clark)	OI Analytical	1030W	P428730168/PARA	2014
Block Digester (Larry)	Andrews	110-40-PA	None on unit	1999
Block Digester (Moe)	Andrews	110-40-PA	None on unit	1999
Block Digester	Andrews	110-40-PA	None on unit	1999

Equipment Instrument	Manufacturer	Model Number	Serial Number	Year in Service
(Curly)				
Block Digester (Carol)	Lachat	BD46 TKN	S/N 00000993	1992
Spec (Snuffleupagus)	Genesys	Spectronic 20	3SGU022007	2016
DO Meter	Mantech	YSI 1500	S/N 13D 100737	2013
Conductivity (Arnie)	ManTech	4310	S/N 1613	1989
Cyanide Distillation	Lab Crest Midi Dist	PRG-2520-BL	S/N 1000-99-01	1999
Flashpoint (Whitey)	Herzog	HFP 339	S/N 073390084	2007
pH Meter (Randolph)	Orion	320	S/N 020032	2007
Turbidimeter (Jack)	HF Scientific	Micro 100	S/N 200705143	2001
Sulfide Distillation	Westco	Easy Dist		2008
Solid Phase Extraction Unit (Earl)	Horizon	SPE-DEX 3000XL	S/N 14-1971	2014

Table 20-2. Schedule of Routine Maintenance

(Refer to manufacturer's instructions for each instrument to identify and perform maintenance operations. Refer to the analytical SOP for frequency and criteria)

Instrument Maintenance Schedule

ION CHROMATOGRAPH

As Needed	Daily	Weekly	Monthly
Check fuses when power problems occur.	Check plumbing/leaks	Check pump heads for leaks. Check Filter inlet	
Reactivate or change column when peak shape and resolution deteriorate or when retention time shortening indicates that exchange sites have become deactivated.	Check pump pressure		

De-gas pump head when flow is erratic.	Check conductivity meter		

HIGH PRESSURE LIQUID CHROMATOGRAPH

Daily	As Needed
Check level of solution in reservoirs. If adding, verify that solvent is from the same source. If changing, rinse delivery lines to prevent contamination of the new solvent.	Replace columns when peak shape and resolution indicate that chromatographic performance of column is below method requirements.
Flush with an appropriate solvent to remove all bubbles.	Rinse flow cell with 1N nitric acid if sensitivity low.
Pre-filter all samples.	Change pump seals when flow becomes inconsistent.
	Repack front end of column Back-flush column.

ICP AND ICP/MS

Daily	Monthly or As Needed	Semi-Annually	Annually
Check vacuum pump gage. (<10 millitorr)	Clean plasma torch assembly to remove accumulated deposits	Change vacuum pump oil	Notify manufacturer service engineer for scheduled preventive maintenance service
Check cooling water supply system is full and drain bottle is not full. Also drain tubing is clear, tight fitting, and has few bends.	Clean nebulizer and drain chamber; keep free flowing to maintain optimum performance	Replace coolant water filter (may require more or less frequently depending on quality of water)	
Check nebulizer is not clogged	Clean filters on back of power unit to remove dust		
Check capillary tubing is clean and in good condition	Replace when needed: - peristaltic pump tubing - sample capillary tubing - autosampler sipper probe		
Check peristaltic pump windings are secure	- Check yttrium position - Check O-rings - Clean/lubricate pump rollers		
Check high voltage switch is on			
Check torch, glassware, aerosol injector tube, and bonnet are clean			

CVAS AND CVAFS

Daily	As Needed	Annually
Change drying tube	Change pump tubing	Change Hg lamp
Check pump tubing/drain tubing	Check/change Hg lamp	
Check gas pressure	Clean optical cell	
Check aperture reading Check tubing	Lubricate pump	

GAS CHROMATOGRAPH

Daily *	As Needed
Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressures.	Clip off front portion of capillary columns. Replace column if this fails to restore column performance, or when column performance (e.g., peak tailing, poor resolution, high backgrounds, etc.) indicates it is required. Quarterly FID: clean detector, only as needed—not quarterly/or semi-annually.
Check temperatures of injectors and detectors. Verify temperature programs by RT shift.	Replace injection port liner when front portion of capillary column is clipped.
Clean injector port weekly for TPH for 8015B, when breakdown fails; otherwise, when RT shift or bad samples run.	Annually FID: replace flame tip, only as needed. Only as needed: ECD--detector cleaning and re-foiling, whenever loss of sensitivity, erratic response, or failing resolution is observed
Check baseline level during analysis of run—not maintenance.	Perform gas purity check (if high baseline indicates that impure carrier gas may be in use).
Inspect chromatogram to verify symmetrical peak shape and adequate resolution between closely eluting peaks, when analyzing pesticides; part of analysis—not maintenance. Clip column leader when chromatography looks bad—not daily.	Replace or repair flow controller if constant gas flow cannot be maintained. Detectors: clean when baseline indicates contamination or when response is low. FID: clean/replace jet, replace ignitor. ECD: follow manufacturer's suggested maintenance schedule. HP 7673 Autosampler: replace syringe, fill wash bottle, dispose of waste bottle contents.

**No daily maintenance done on any instrument/method. Weekly change IPL on TPH instrument. Everything else is on an "as needed" basis.*

MASS SPECTROMETER

Daily	Weekly	As Needed	Quarterly	Annually
Check for sufficient gas supply. Check for correct column flow and/or inlet pressure.	Check mass calibration	Check level of oil in mechanical pumps and diffusion pump if vacuum is insufficient. Add oil if needed between maintenance.	Check ion source and analyzer (clean, replace parts as needed)	Replace the exhaust filters on the mechanical rough pump every 1-2 years.
Check temperatures of injector, detector. Verify temperature programs.		Replace electron multiplier when the tuning voltage approaches the maximum and/or when sensitivity falls below required levels.	Check vacuum, relays, gas pressures and flows	
Check inlets, septa		Clean Source, including all ceramics and lenses - the source cleaning is indicated by a variety of symptoms including inability of the analyst to tune the instrument to specifications, poor response, and high background contamination.	Change oil in the mechanical rough pump.	
Check baseline level		Repair/replace jet separator.		
Check values of lens voltages, electron multiplier, and relative abundance and mass assignments of the calibration compounds.		Replace filaments when both filaments burn out or performance indicates need for replacement.		

ANALYTICAL/TOP LOADING BALANCES

Daily	Annually
Check using Class 1-verified weights once daily or before use Clean pan and weighing compartment	Manufacturer cleaning and calibration

REFRIGERATORS/WALK-IN COOLERS

Daily	As Needed
Temperatures checked and logged	Refrigerant system and electronics serviced

OVENS

Daily	As Needed
Temperatures checked and logged	Electronics serviced

SPECIFIC DIGITAL ION ANALYZER

Daily	As Needed
Daily when used: Calibrate with check standards Inspect electrode daily, clean as needed Inspect electrode proper levels of filling solutions daily; fill as needed Clean probe after each use	Electronics serviced

TURBIDIMETER

Daily	Monthly	As Needed
Daily when used: Adjust linearity on varying levels of NTU standards. Standardize with NTU standards Inspect cells	Clean instrument housing	Electronics serviced

DISSOLVED OXYGEN METER

Daily	As Needed
Daily when used: Calibrate with saturated air Check probe membrane for deterioration Clean and replace membrane with HCl solution	Electronics serviced Clean and replace membrane with HCl solution

CONDUCTANCE METER

Daily	As Needed
Daily when used: Check probe and cables Inspect conductivity cell	Electronics serviced

CHEMICAL OXYGEN DEMAND (COD) REACTOR 1

Daily	As Needed
Daily when used: Calibrate with check standards	Electronics serviced

SPECTROPHOTOMETER

As Needed	Daily	Monthly	Annually
Dust the lamp and front of the front lens	Check the zero % adjustment	Clean windows	Check instrument manual
	Clean sample compartment		Perform wavelength calibration
	Clean cuvettes		Replace lamp annually or when erratic response is observed
			Clean and align optics

pH METER

As Needed	Daily
Clean electrode	Inspect electrode. Verify electrodes are properly connected and filled
Refill reference electrode	Inspect electrode proper levels of filling solutions. Make sure electrode is stored in buffer

TOTAL ORGANIC CARBON ANALYZER

Daily	As Needed	Weekly	Monthly
Check: Oxygen supply Persulfate supply Acid supply Carrier gas flow rate (~ 150 cc/min) IR millivolts for stability (after 30 min. warm-up) Reagent reservoirs	Check injection port septum Indicating drying tube NDIR zero, after change in color indicator Permeation tube, every 6 months of use	Check liquid-flow-rate-pump-tubing conditions on autosampler Check injection port septum	Clean digestion vessel Clean condenser column Do the leak test

DIGESTION BLOCK

Annually
Check temperature with NIST thermometer

Flash Point Tester

Daily
Check tubing Clean sample cup each use
Clean flash assembly
Check stirrer

SECTION 21. MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements must be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard must be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices (refer to Section 20.3). With the exception of Class A glassware and glass microliter syringes , quarterly accuracy checks are performed for all mechanical volumetric devices. Microsyringes are verified at least semi-annually or disposed of after six months of use. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A glassware and glass microliter syringes should be routinely inspected for chips, acid etching, or deformity (e.g., bent needle). If the Class A glassware or syringe are suspect, the accuracy of the glassware must be assessed prior to use.

21.2 NIST-Traceable Weights and Thermometers

Reference standards of measurement must be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), or another accreditation organization that is a signatory to a

MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International Laboratory Accreditation Cooperation) or APLAC (Asia-Pacific Laboratory Accreditation Cooperation). A calibration certificate and scope of accreditation is kept on file at the laboratory. An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All spirit thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor-certified different lot is acceptable for use as a second source. For unique situations, where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g., calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to The Corporate Environmental Health & Safety Manual (CW-E-M-001) or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials must not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards. Some regulatory programs, such as Ohio VAP, prohibit the use of re-verified standards.

21.4. Documentation And Labeling Of Standards, Reagents, And Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to companywide purchase. Refer to TestAmerica's Corporate SOP CA-Q-S-001, Solvent and Acid Lot Testing and Approval.

All manufacturer or vendor-supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained in each group. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to method specific SOPs.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96%, a correction must be made to concentrations applied to solutions prepared from the stock commercial material. Blended gas standard cylinders use a nominal concentration if the certified value is within +/-15%, otherwise the certified values are used for the canister gas concentrations.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS:

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation date
- Expiration date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)

- Parent standard ID (if applicable)
- Parent standard analyte concentration (if applicable)
- Parent standard amount used (if applicable)
- Component analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically in each group for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date, and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration date (include prep date for reagents)
- Standard ID (from LIMS)
- Special health/safety warnings, if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date or preparation for laboratory prepared items. Special health/safety warnings must also be available to the analyst. This information is maintained in the analytical SOP.

21.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended storage conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date, and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets, and preparation and batch records.

All reagents and standards must be stored in accordance to the following priority: 1)With the manufacturer's recommendations; 2)With requirements in the specific analytical methods as

specified in the laboratory SOP

SECTION 22. SAMPLING

22.1 Overview

The laboratory provides sampling services. Sampling procedures are described in SOP NC-SC-006, Sample Procurement Protocol.

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Certificates of cleanliness provided by the supplier are maintained at the laboratory. Alternatively, the certificates are available from the vendor electronically and available to the laboratory online.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 Definition Of Holding Time

The date and time of sampling documented on the Chain-of-Custody (COC) form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends 24 hours after sampling. Holding times for analysis include any necessary re-analysis. However, there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of holding time length.

22.4 Sampling Containers, Preservation Requirements, Holding Times

The preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method-required holding times or preservation

requirements are not met, the reports must be qualified using a flag, footnote, or case narrative. As soon as possible, or "ASAP", is an EPA designation for tests for which rapid analysis is advised; but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample needs consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative sub-sample or aliquot of the sample provided for analysis. In that regard the following guidelines apply to analysts:

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots and sub-sampling are located in each analytical SOP and in Subsampling SOP NC-OP-046.

SECTION 23. HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the Sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification

- Date, time, and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's Field technician until the samples are delivered to the laboratory personnel. The sample collector must assure each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the Sample Control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (FedEx, UPS), the COC relinquished date/time is completed by the Field personnel; and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The COC is stored with project information and the report.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC, login will complete the custody seal, retain the shipping record with the COC, and initiate an internal COC for laboratory use by analysts and a sample disposal record.

23.2 Sample Receipt

Samples are received at the laboratory by designated Sample Receiving personnel, and a unique laboratory project identification number is assigned. Each sample container must be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking, and storage procedures are summarized in the following sections. SOP NC-SC-005, Sample Receiving, describes the laboratory's sample receipt procedure.

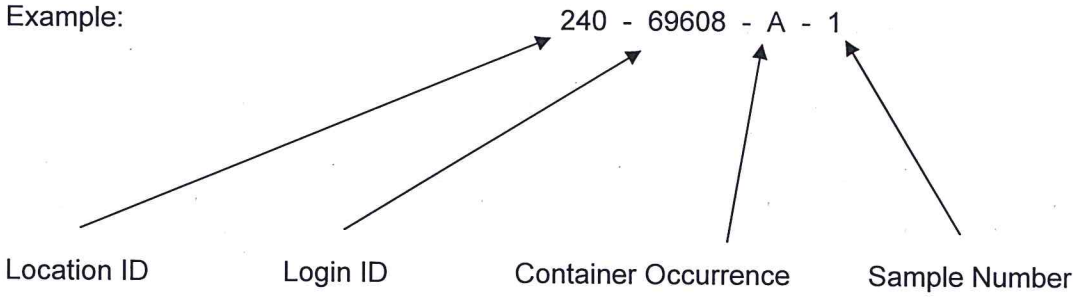
23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on a ***Cooler Receipt Form*** and brought to the immediate attention of the Project Manager, who will contact the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at any time. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):



The above example states that TestAmerica Canton Laboratory (Location 240). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: 240 - 9608 - A - 1 - A ← Secondary Container Occurrence

Example: 240-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy outlined in SOP NC-SC-005, Sample Receiving, that clearly outlines the circumstances under which samples must be accepted or rejected. These include:

- A COC filled out completely
- Samples must be properly labeled
- Proper sample containers with adequate volume for the analysis and necessary QC
- Samples must be preserved according to the requirements of the requested analytical method
- Sample holding times must be adhered to
- All samples submitted for water/solid Volatile Organic analyses must have a Trip Blank submitted at the same time
- The Project Manager must be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into LIMS according to SOP NC-SC-005.

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers, or protected locations suitable for the sample matrix. Metals samples may be unrefrigerated. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards, or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every week.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples, including empty sample containers, are returned to the secure sample control area. All samples are kept in the refrigerators for a minimum of 30 days after report generation, which meets or exceeds most sample holding times. After this time period, the samples are removed from the refrigerator shelves and prepared for disposal. Special arrangements may be made to store samples for longer periods of time.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 Hazardous Samples And Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for hazardous waste only. For any sample that is known to be hazardous at the time of receipt or, if after completion of analysis the result exceeds the acceptable regulatory levels, a Hazardous Sample Notice must be completed by the analyst. This form may be completed by Sample Control, Project Managers, or analysts and must be attached to the report. The sample itself is clearly marked with a red stamp, stamped on the sample label reading "HAZARDOUS" or "FOREIGN SOIL" and placed in a colored and/or marked bag to easily identify the sample. The date, log number, lab sample number, and the result or brief description of the hazard are all written on the Hazardous & Foreign Soil Sample Notice. A copy of the form must be included with the original COC and Work Order and the original must be given to the Sample Control Custodian. Analysts will notify Sample Control of any sample determined to be hazardous after completion of analysis by completing a Hazardous Sample Notice. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

See SOP NC-SC-019 Procedure of Acceptance and Handling of USDA Regulated Domestic and Foreign Soil for further information.

23.6 Sample Shipping

In the event the laboratory needs to ship samples, the samples are placed in a cooler with enough ice, where required, to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses. The Chain-of-Custody form is signed by the Sample Control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper Chain-of-Custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will analyze the trip blanks that were supplied and will notify the client that the trip blank was omitted from the CoC.

23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after the project report is sent; however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist--the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP NC-SC-005, Sample Receiving and Sample Control). All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work. Waste disposal complies with all federal and state laws and regulations.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), and names of individuals who conducted the arrangements and physically completed the task. Sample labels are destroyed through the disposal method, e.g., samples are incinerated. A Waste Manifest is completed.

Figure 23-1. Example: Chain of Custody (COC)

TestAmerica North Canton
4101 Shuffle Drive N.W.
North Canton, OH 44720
phone 330-497-9396 fax 330-497-0772

Chain of Custody Record

Client Contact	Project Manager:	Site Contact:	Date:
Your Company Name here	Tel/Fax:	Lab Contact:	Carrier:
Address	Analysis Turnaround Time		
City/State/Zip	Calendar (C) or Work Days (W)		
(xxx) xxx-xxxx Phone	TAT if different from Below		
(xxx) xxx-xxxx FAX	☐ 2 weeks		
Project Name:	☐ 1 week		
Site:	☐ 2 days		
PO #	☐ 1 day		

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ☐ Months

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:
Relinquished by:	Company:	Date/Time:	Received by:	Company:
Relinquished by:	Company:	Date/Time:	Received by:	Company:

Figure 23-3. Example: Internal Chain of Custody (COC)

TestAmerica Laboratories, Inc.

Sample Control Record

Client:

Lot Number:

Case Number/SDG:

Storage Location:

Laboratory Sample ID	Transferred By	Date	Entered	Removed	Reason	Date Returned

Figure 23-4. Example: Cooler Receipt Form

TestAmerica Canton Sample Receipt Form/Narrative Login # :_____

Client Site Name_____ By:_____

Cooler Received on _____ Opened on_____ (Signature)

FedEx: 1st Grd Exp UPS FAS Stetson Client Drop Off TestAmerica Courier Other_____

TestAmerica Cooler # _____ Foam Box Client Cooler Box Other _____

Packing material used: Bubble Wrap Foam Plastic Bag None Other _____

COOLANT: Wet Ice Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt

IR GUN# 1	(CF -2°C)	Observed Sample Temp._____°C	Corrected Sample Temp._____°C
IR GUN# 4G	(CF -1°C)	Observed Sample Temp._____°C	Corrected Sample Temp._____°C
IR GUN# 5G	(CF -1°C)	Observed Sample Temp._____°C	Corrected Sample Temp._____°C
IR GUN# 6Y	(CF -2°C)	Observed Sample Temp._____°C	Corrected Sample Temp._____°C

2. Were custody seals on the outside of the cooler(s)?	If Yes	Yes No
-Were custody seals on the outside of the cooler(s) signed & dated?		Yes No NA
-Were custody seals on the bottle(s)?		Yes No
3. Shippers' packing slip attached to the cooler(s)?		Yes No
4. Did custody papers accompany the sample(s)?		Yes No
5. Were the custody papers relinquished & signed in the appropriate place?		Yes No
6. Did all bottles arrive in good condition (Unbroken)?		Yes No
7. Could all bottle labels be reconciled with the COC?		Yes No
8. Were correct bottle(s) used for the test(s) indicated?		Yes No
9. Sufficient quantity received to perform indicated analyses?		Yes No
10. Were sample(s) at the correct pH upon receipt?		Yes No NA
11. Were VOAs on the COC?		Yes No
12. Were air bubbles >6 mm in any VOA vials?		Yes No NA
13. Was a trip blank present in the cooler(s)?		Yes No

Contacted PM _____ Date _____ by _____ via Verbal Voice Mail Other

Concerning _____

14. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES

15. SAMPLE CONDITION

Sample(s)_____were received after the recommended holding time had expired.

Sample(s)_____ were received in a broken container.

Sample(s)_____were received with bubble >6 mm in diameter. (Notify PM)

16. SAMPLE PRESERVATION

Sample(s) _____ were further preserved in Sample Receiving to meet recommended pH level(s). Nitric Acid Lot# 110410-HNO3; Sulfuric Acid Lot# 041911-H2SO4; Sodium Hydroxide Lot# 121809 -NaOH; Hydrochloric Acid Lot# 041911-HCl; Sodium Hydroxide and Zinc Acetate Lot# 100108-(CH3COO)2ZN/NaOH. What time was preservative added to sample(s)? _____

Client ID	pH	Date	Initials

Cooler #	Observed Sample Temp. °C	Corrected Sample Temp. °C	IR #	Coolant

SECTION 24. ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g., Method Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Example – Negative Controls

Control Type	Details
Method Blanks (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Re-analyze or quality-associated sample results when the concentration of a targeted analyte in the method blank is at, or above, the reporting limit as established by the method or by regulation, AND is greater than 1/20 of the amount measured in the sample.
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.

Table 24-1. Example – Negative Controls

Control Type	Details
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.
Trip Blanks [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1]When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon: (1) Method Performance [Laboratory Control Sample (LCS) or Blank Spike (BS)], which entails both the preparation and measurement steps; (2) Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch.

Note that frequency of control samples vary with specific regulatory, methodology, and project-specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g., solid matrix LCS for metals, TDS, etc.).

The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally one for each batch of sample--not to exceed 20 environmental samples.

If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable, e.g., no spike of pH. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

For methods that have 1-10 target analytes, spike all components.

For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

For methods with more than 20 target analytes, spike at least 16 components.

Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

Exception: Due to analyte incompatibility between the various PCB Aroclors, Aroclors 1016 and 1260 are used for spiking as they cover the range of all of the Aroclors. Specific Aroclors may be used by request on a project-specific basis.

24.5 Sample Matrix Controls

Table 24-2 Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	To assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects.If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	Essentially, a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the control limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

1 See the specific analytical SOP for type and frequency of sample matrix control samples.

2 LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 Acceptance Criteria (Control Limits)

As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project-specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes, and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

Note: For Ohio VAP the laboratory must implement Corrective Action procedures to resolve the deviation and limit qualification of the final results. The laboratory is not permitted to deviate from its VAP approved SOP if it intends to attest under affidavit that the "results" are VAP certified. When all corrective actions listed in the SOP have been exhausted, it may be necessary to use technical judgment in which case the decision process and rationale will be presented in the final report and/or affidavit and the data will be noted as 'not VAP certified' on the affidavit.

Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

Laboratory-generated Percent Recovery acceptance (control) limits are generally established by taking +3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

- Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV), (unless the analytical method specifies a tighter limit).

- In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) an be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

- The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5%, and the analyte must be detectable and identifiable.

- The maximum acceptable recovery limit will be 200%.

The maximum acceptable RPD limit will be 35% for water matrices and 40% for solid matrices The minimum RPD limit is 10%.

24.6.1 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. Refer to NC-QA-018, Statistical Evaluation of Data and Development of Control Charts, for details.

24.6.2 An LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the control limits may be determined as out of control and should be re-analyzed if possible. If re-analysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal Corrective Action process (see Section 12) is also initiated if an LCS exceeds the control limits. Sample results may be qualified and reported without re-analysis if:

- The analyte results are below the reporting limit and the LCS is above the upper control limit.
- If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.
- Note: For Ohio VAP the laboratory must implement Corrective Action procedures to resolve the deviation and limit qualification of the final results. The laboratory is not permitted to deviate from its VAP approved SOP if it intends to attest under affidavit that the "results" are VAP certified. When all corrective actions listed in the SOP have been exhausted, it may be necessary to use technical judgment in which case the decision process and rationale will be presented in the final report and/or affidavit and the data will be noted as 'not VAP certified' on the affidavit.

24.6.3 If the MS/MSDs do not meet control limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and re-analyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.4 If a surrogate standard falls outside the control limits, and if there is not obvious chromatographic matrix interference, re-analyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the re-analysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client).

24.7 Additional Procedures to Assure Quality Control

The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21), and use of PT samples (see Section 15).

A discussion regarding MDLs, Limit of Detection (LOD), and Limit of Quantitation (LOQ) can be found in Section 19.

- Use of formulae to reduce data is discussed in the method SOPs and in Section 20.
- Selection of appropriate reagents and standards is included in Sections 9 and 21.
- A discussion on selectivity of the test is included in Section 5.
- Constant and consistent test conditions are discussed in Section 18.
- The laboratory sample acceptance policy is included in Section 23.

SECTION 25. REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is a conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory must work with the client during project setup to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is reviewed and signed electronically by the appropriate Project Manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title with a "Sample Result" header.

25.2.2 Each report cover page printed, which includes the laboratory name, address, and telephone number.

25.2.3 A unique identification of the report (e.g., Work Order number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented at the bottom of each page. The report is sequentially paginated. A copy of the Chain-of-Custody (COC). Any COCs involved with subcontracting are included.

25.2.4 The name and address of client and a project name/number, if applicable.

25.2.5 Client project manager or other contact

25.2.6 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.7 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.8 Date reported or date of revision, if applicable

25.2.9 Method of analysis including method code (EPA, Standard Methods, etc)

25.2.10 Reporting limit

25.2.11 Method detection limits (if requested)

25.2.12 Definition of data qualifiers and reporting acronyms, e.g., ND

25.2.13 Sample results

25.2.14 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits

25.2.15 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (refer to Section 25.2.4 – Item 3, regarding additional addenda).

25.2.16 A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error,

25.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.18 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.19 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Authorized signatories are qualified Project Managers appointed by the Manager of Project Managers

25.2.20 When TNI accreditation is required, the lab must certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.

25.2.21 The laboratory includes a cover page.

25.2.22 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.23 When soil samples are analyzed, a specific identification as to whether soils are reported on a "wet weight" or "dry weight" basis.

25.2.24 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.25 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report, e.g., partial report, or how your lab identifies it. A complete report must be sent once all of the work has been completed.

25.2.26 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.27 Certification Summary report, where required, will document that unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy CA-L-P-002 for details on internally applying electronic signatures of approval.

25.2.28 Reports for Ohio VAP work require a VAP affidavit be completed and included with the report. One affidavit can be provided for multiple reports for a project.

Note: For additional information on Ohio VAP affidavits refer to OAC Rule 3745-300-04 and OAC Rule 3745-300-13(N), effective March 1, 2009.

25.3 Reporting Level or Report Type

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level 1 is a report with all of the elements outlined in Section 25.2 above, excluding 25.2.15 (QC data) Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.

- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.

- Level IV is the same as Level III with the addition of all raw supporting data. In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Procedures used to ensure client confidentiality are outlined in Section 25.7.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica services. When NELAP accreditation is required and both a test report and EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD. TestAmerica Canton offers a variety of EDD formats including (but not limited to) ADR, EQuIS, GISKey, Region 5, NJHAZ site, and a wide variety of client specific multi-file, Excel and flat file formats.

EDD specifications are submitted to the IT Department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the

EDD.

EDDs must be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information For Test

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response must be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 Environmental Testing Obtained From Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP CA-L-S-002, Subcontracting.

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client.

25.6 Client Confidentiality

In situations involving the transmission of environmental test results by telephone, facsimile, or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the client or any other person designated by the client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

"Confidentiality Notice: The information contained in this message is intended only for the use of the addressee, and may be confidential and/or privileged. If the reader of this message is not the intended recipient, or the employee or agent responsible to deliver it to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify the sender immediately."

25.7 Format of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 Amendments to Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

When the report is re-issued, a notation of "report reissue" is placed on the cover/signature page of the report or at the top of the narrative page with a brief explanation of reason for the reissue and a reference back to the last final report generated.

25.9 Policies on Client Requests for Amendments

25.9.1 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements
- The requested change has absolutely no possible impact on the interpretation of the analytical results and there is no possibility of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

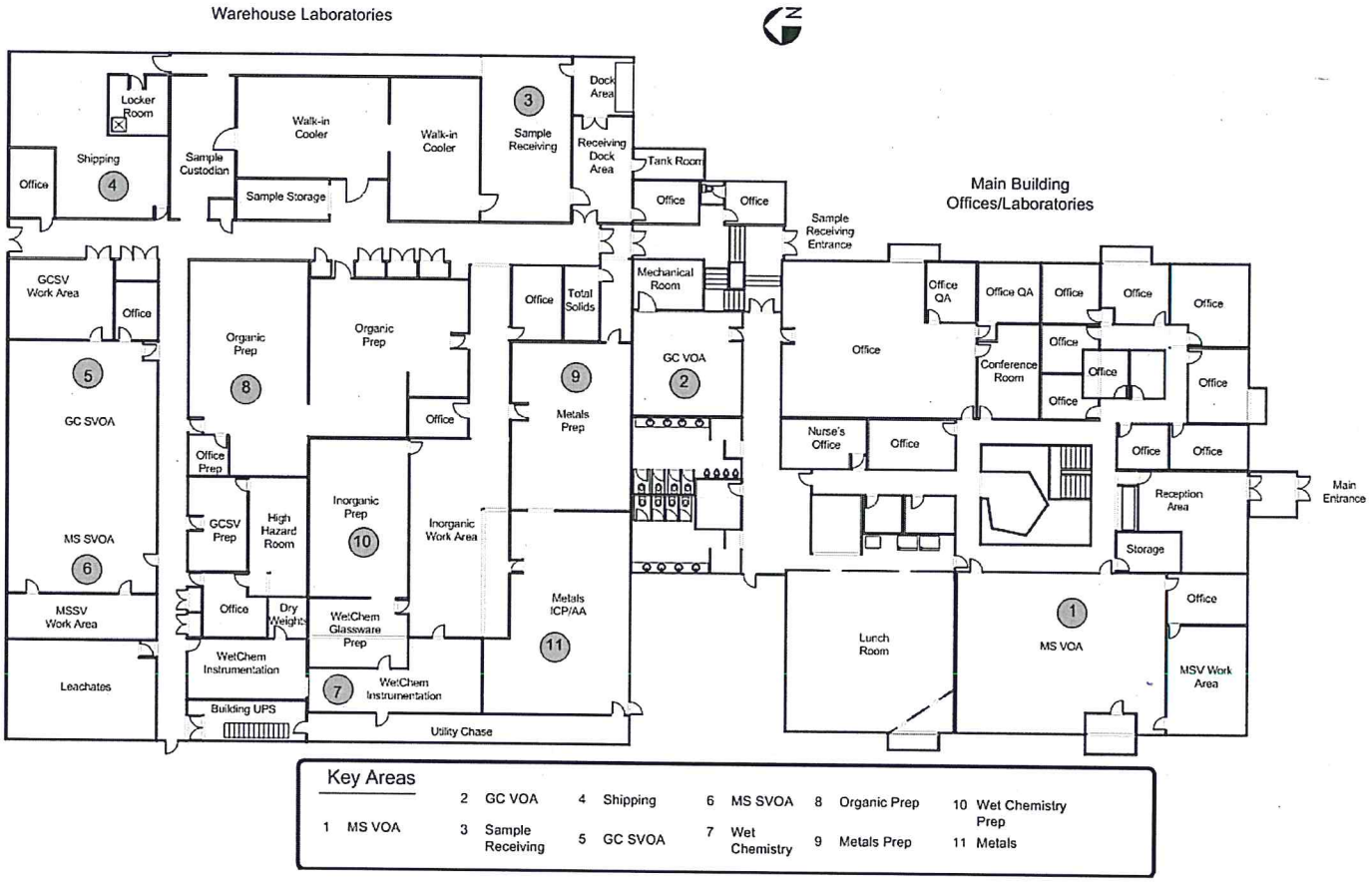
TestAmerica does not issue multiple reports for the same work order where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1: Laboratory Floor Plan

TestAmerica – North Canton

4101 Shuffel Dr NW
North Canton, OH 44720

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING



Appendix 2. Laboratory Method Listing

Inorganic Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Biological
Alkalinity	SM2320B	X			
Ammonia	SM4500NH3_C	X	X	X	
	SM4500NH3_D	X			
	EPA 350.2	X	X	X	
Anions, Ion Chromatography	EPA 300.0	X	X	X	
	EPA 9056A	X	X	X	
BOD, 5-Day	SM5210B	X	X		
Chloride	EPA 9251	X	X	X	
	SM4500_Cl_E	X	X	X	
Chlorine, Residual	SM4500_CL_G	X			
Chlorine (Total Residual), Field	SM4500_RES_CL_F	X			
Chromium, Hexavalent	SM3500_CR_B	X			
	EPA 7196A	X	X	X	
COD	EPA 410.4	X	X		
	SM 5220D	X	X		
Conductivity, Specific Conductance	EPA 120.1	X			
	SM2510B	X	X	X	
	EPA 9050A	X	X	X	
Cyanide, Amenable	SM4500_CN_G	X	X		
	EPA 9012A	X	X	X	
	EPA 9012B	X	X	X	
Cyanide, Total	EPA 335.4	X	X	X	
	SM4500_CN_E	X	X	X	
	EPA 9012A	X	X	X	
	EPA 9012B	X	X	X	
Cyanide, Weak Acid Dissociable	SM4500_CN_I	X	X	X	
Fluoride	SM4500_F_C	X	X	X	
Hardness, Total (mg/l as CaC03)	SM2340C	X	X	X	
HEM and SGT-HEM	EPA 1664A	X			
Ignitability, Pensky-Martens Closed-Cup Method	EPA 1010	X	X	X	
	EPA 1010A	X	X	X	
Iron, Ferric	SM3500_F+3_B	X			
Iron, Ferrous	SM3500_F+2_B	X			
Methylene Blue Active Substances (MBAS)	SM5540C	X			
% Moisture / Total Solids	ASTM D2216-80		X	X	X
Nitrogen, Nitrate-Nitrite	EPA 353.2	X	X	X	
Nitrogen, Total Kjeldahl	SM4500Norg_C	X	X	X	
Organic Carbon, Total (TOC)	EPA 9060	X	X	X	
	EPA 9060A	X			

	SM5310C	X	X	X	
	WalkleyBlk_Calc		X	X	
Organic Halides, Extractable (EOX)	EPA 9023		X	X	
Oxygen, Dissolved	SM4500_O_G	X		X	
Paint Filter	EPA 9095A		X	X	
	EPA 9095B		X	X	
Percent Moisture	Moisture		X	X	
pH	EPA 9040B	X	X	X	
	EPA 9040C	X	X	X	
	EPA 9041A	X	X	X	
	EPA 9045C		X	X	
	EPA 9045D		X	X	
	SM4500H+	X	X	X	
Phenolics, Total Recoverable	EPA 420.1	X	X	X	
	EPA 9065	X	X	X	
Phosphorus, Orthophosphate	EPA 365.3_Ortho	X			
	EPA4500_P_E_Ortho	X	X	X	
Phosphorus, Total	EPA 365.3	X			
	EPA 4500_P_E	X	X		
Solids, Settleable	SM2540F	X			
Solids, Total	SM2540B	X	X	X	
Solids, Total Dissolved (TDS)	SM2540C	X	X	X	
Solids, Total Suspended (TSS)	SM2540D	X			
Specific Gravity	SM2710F	X		X	
Sulfide, Acid soluble and Insoluble (Titrimetric)	EPA 9030/9034	X	X	X	
	SM4500_S2_F	X			
Turbidity, Nephelometric	EPA 180.1	X			

Metals Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Biological
Mercury, Low Level (CVAFS)	EPA 1631E	X	X	X	X
Metals (ICP)	EPA 200.7	X			
	EPA 6010B	X	X	X	X
	EPA 6010C	X	X	X	X
Metals (ICP/MS)	EPA 200.8	X			
	EPA 6020	X	X	X	X
	EPA 6020A	X	X	X	X
Mercury (CVAA)	EPA 245.1	X			
	EPA 7470A	X			
	EPA 7471A		X	X	X
	EPA 7471B		X	X	X
Chromium, Trivalent	EPA 3500_CR3_B	X	X	X	X
	EPA 7196A_CR3	X	X	X	X
Total Hardness (as CaCO3) by calculation	SM2340B	X	X	X	

Organic Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Biological
Methyl Mercury (GC)	EPA 1630	X	X	X	X
Diesel Range Organics (DRO) (GC)	EPA 8015B_DRO	X	X	X	X
	EPA 8015C_DRO	X	X	X	X
	EPA 8015D_DRO	X	X	X	X
Organochlorine Pesticides (GC)	EPA 608	X			
	EPA 8081A	X	X	X	X
	EPA 8081B	X	X	X	X
Polychlorinated Biphenyls (PCBs) by Gas Chromatography	EPA 608	X			
	EPA 8082	X	X	X	X
	EPA 8082A	X	X	X	X
Herbicides (GC)	EPA 8151A	X	X	X	X
Wisconsin - Diesel Range Organics (GC)	WI_DRO	X	X	X	X
Gasoline Range Organics - (GC)	EPA 8015B_GRO	X	X	X	X
	EPA 8015C_GRO	X	X	X	X
	EPA 8015D_GRO	X	X	X	X
Nonhalogenated Organic using GC/FID (Direct Aqueous Injection)	EPA 8015C_DAI	X	X		
Dissolved Gases (GC)	ASTM D8028	X			
	RSK_175	X			
Wisconsin - Gasoline Range Organics (GC)	WI_GRO	X	X	X	X
Formaldehyde by HPLC	EPA 8315A	X	X	X	X
Aromatic Acids (HPLC)	Aromatic_Acids	X	X	X	X
Semivolatile Organic Compounds (GC/MS)	EPA 625	X			
	EPA 8270C	X	X	X	X
	EPA 8270C_SIM	X	X	X	X
	EPA 8270D	X	X	X	X
	EPA 8270 1,4-Dioxane by Isotope Dilution	X	X		
Volatile Organic Compounds (GC/MS)	EPA 624	X			
	EPA 8260A	X	X	X	X
	EPA 8260B	X	X	X	X
	EPA 8260B_SIM	X	X	X	X
	EPA 8260C	X	X	X	X

Preparation Only Methods

Parameter	Method	Aqueous	Solid	Waste	Biological
Florisil Cleanup	EPA 3620B	X	X	X	X
Silica Gel Cleanup	EPA 3630C	X	X	X	X
Acid-Base Partition Cleanup	EPA 3650B	X	X	X	X
Sulfur Cleanup	EPA 3660B	X	X	X	X
Sulfuric Acid/Permanganate Cleanup	EPA 3665A	X	X	X	X
Liquid-Liquid Extraction (Continuous)	EPA 3520C	X			
Soxhlet Extraction	EPA 3540C		X	X	X
Microwave Extraction	EPA 3546		X	X	X
Ultrasonic Extraction	EPA 3550B		X	X	X
Ultrasonic Extraction	EPA 3550C		X	X	X
Waste Dilution	EPA 3580A		X	X	X
Extraction (Herbicides)	EPA 8151A	X	X	X	X
Purge and Trap	EPA 5030B	X	X	X	
Purge and Trap	EPA 5030C	X	X	X	
TCLP Extraction	EPA 1311	X	X	X	
SPLP Extraction	EPA 1312_E	X	X	X	
SPLP Extraction	EPA 1312_W	X	X	X	
ASTM Leaching Procedure	ASTM_LEACH		X	X	
Alkaline Digestion (Chromium, Hexavalent)	EPA 3060A		X	X	
Liquid-Liquid Extraction (Separatory Funnel)	EPA 3510C	X			
Closed System Purge and Trap	EPA 5035A	X	X	X	X
Preparation, Total Recoverable or Dissolved Metals	EPA 3005A	X			
Preparation, Total Metals	EPA 3010A	X			
Preparation, Metals	EPA 3050B		X	X	X

Appendix 3. Glossary/Acronyms

Glossary

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQ)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Anomaly: A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory's control or not.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch: Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed 20 samples. (TNI)

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (TNI)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQ)

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard: A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM): A reference material accompanied by a certificate having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute.

Chain-of-Custody (COC) Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes the number and types of containers, the mode of collection, the collector, time of collection, preservation, and requested analyses. (TNI)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation

Alternate wavelength

Derivatization

Mass spectral interpretation

Alternative detectors or

Additional cleanup procedures

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis. No significant action is taken to change behavior, process or procedure.

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria).

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors and collation into a more useable form. (TNI)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQ)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQ)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank: Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank: Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times: The maximum time that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration: Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is + 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. An LCS must be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples must be used to determine batch acceptance.

Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit(s) of Detection (LOD) (a.k.a., Method Detection Limit [MDL]): A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliabl detect in their facility. (TNI)

LOD Verification (a.k.a., MDL Verification): A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions must be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with ,15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples must be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with .15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air and Emissions: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike is prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit: The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Observation: A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material: A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Method: A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard: A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.0-8)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r2 must be greater than or equal to 0.99.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Spike: A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method of an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPS are officially approved as the methods for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and must be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Trip Blank: A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Uncertainty: A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms

ASTM	American Society for Testing & Materials
CAR	Corrective Action Report
CBI	Confidential Business Information
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CF	Calibration Factor
CFR	Code of Federal Regulations
COC	Chain of Custody
CQMP	Corporate Quality Management Plan
CSM	Customer Service Manager
DOC	Demonstration of Capability
DQO	Data Quality Objectives
DUP	Duplicate
ECO	Ethics and Compliance Officer
EDD	Electronic Data Deliverable
EHS	Environment, Health and Safety
EPA	Environmental Protection Agency
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
HPLC	High Performance Liquid Chromatography
ICP	Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS	ICP/Mass Spectrometry
ICB	Initial Calibration Blank
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IEC	International Electrotechnical Commission
IS	Internal Standard
ISO	International Organization for Standardization
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantitation
LIMS	Laboratory Information Management System

MDL	Method Detection Limit
MDLCK	MDL Check Standard
MDLV	MDL Verification Check Standard
MRL	Method Reporting Limit Check Standard
MS	Matrix Spike
MSD	Matrix Spike Duplicate
SDS	Safety Data Sheet
NCM	Nonconformance Memo
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
NPDES	National Pollutant Discharge Elimination System
OVAP	Ohio Voluntary Action Program
PM	Project Manager
PT	Performance Testing
TIC	Tentatively Identified Compound
TNI	The NELAC Institute
QAM	Quality Assurance Manual
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RF	Response Factor
RFP	Request for Proposal
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SD	Standard Deviation
SOP	Standard Operating Procedure
SPLP	SPLP = Synthetic Precipitation Leaching Procedure
TAT	Turn-Around Time
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
USDA	United States Department of Agriculture
VOA	Volatiles

Appendix 4. Laboratory Certifications, Accreditations, Validations

TestAmerica Canton maintains certifications, accreditations, certifications, and approvals with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

Organization	Certificate Number	Organization	Certificate Number
California	01144CA	Nevada	OH-00048208A
Connecticut	PH-0590	New Jersey	OH001
Florida	E87225	New York	10975
Georgia	---	OVAP	CL0024
Illinois	001298	Pennsylvania	68-00340
Kansas	E-10336	USDA (Dept. of Agriculture)	P330-08-00123
Kentucky Underground Storage Tank Program	0058	Washington	C971
Minnesota	039-999-348	West Virginia	210
		Wisconsin	999518190
Texas	T104704517-13-2	Virginia	2857
Oregon	4062	Kentucky Wastewater	98016
Minnesota Petrofund	3506		

The certificates and accredited parameter lists are available for each State/Program at www.testamericainc.com under Analytical Services Search – Certifications.

APPENDIX B

MID-ATLANTIC ENVIRONMENTAL CONSULTANTS, INC. LABORATORY GENERAL OPERATING PROCEDURES FOR POLARIZED LIGHT MICROSCOPY (PLM)

MID ATLANTIC ENVIRONMENTAL CONSULTANTS, INC.
GIBSONIA, PENNSYLVANIA

LABORATORY GENERAL OPERATION PROCEDURES FOR POLARIZED LIGHT MICROSCOPY (PLM)

AIHA LABORATORY #: 102968

PREPARED BY:

MID ATLANTIC ENVIRONMENTAL CONSULTANTS, INC.
5320 NORTH PIONEER ROAD
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Table of Contents

Mid-Atlantic Environmental Consultants

5320 N. Pioneer Road
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Purpose

The purpose of these operation procedures is to ensure that Mid Atlantic Environmental Consultants, Inc. laboratory operates in an efficient manner with minimal deficiencies. We are committed to customer satisfaction, integrity and 100 % proficiency in regards to Polarized Light Microscopy (PLM) analysis. Our laboratory maintains thorough record keeping in which we feel is equivalent to and / or supersedes all other laboratories. This is why we truly perform each analytical work task with the utmost attention to detail.

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Laboratory Environment

Mid Atlantic Environmental Consultants, Inc. monitors the asbestos laboratory for contamination on a routine basis. Laboratory blanks, using asbestos free materials, are prepared and analyzed with sufficient frequency to detect possible contamination of laboratory equipment or supplies. Periodic ambient air quality testing is also performed utilizing high volume sampling equipment and 25 mm cassettes with mixed cellulose ester fibers. Results of all testing are posted on the laboratory bulkhead. Periodic cleaning of the laboratory floors and countertops is performed utilizing baby wipes, Pine-Sol detergent and other cleaning materials.

The laboratory has sufficient space, lighting and environmental controls to operate efficiently. A deep sink with hot and cold running water is present in the far left hand corner of the laboratory. The flooring consists of 12 x 12 vinyl floor tile and the walls are constructed of white painted hard plaster.

All laboratory waste is periodically disposed of by a Pennsylvania State Licensed Asbestos Abatement Contractor. The contractor provides Mid Atlantic with a waste disposal manifest upon completion of all laboratory waste disposal. All manifests are stored / kept in the laboratory in a two-drawer cabinet underneath the countertops.

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Quality Control

Mid Atlantic Environmental Consultants, Inc. is enrolled in the American Industrial Hygiene Association's (AIHA) Proficiency Analytical Testing Program. The proficiency testing materials, in general, are representative examples of bulk materials. The materials will test the laboratory's ability to follow the method and to achieve the proper accuracy, precision, and detection limits. Testing is implemented on a quarterly basis (every 3 months).

Mid Atlantic also performs interlaboratory quality assurance analysis on 10 % of the total number of analyses performed. Intra-laboratory analysis is also performed utilizing NVLAP accredited laboratories to compare results of independent techniques.

Contamination checks using asbestos free materials, such as glass fibers are performed daily.

The laboratory's quality documentation contains procedures or instructions describing the following:

- Training of staff and quality assurance analyst performance
- Sample custody and handling procedures
- Analysis of samples and methods to ensure the accuracy and precision of analyses
- Equipment maintenance and calibration of refractive index liquids
- Contamination control
- Record keeping and generation of reports

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Personnel

The laboratory is maintained and operated by Mr. Timothy Daniels. Mr. Daniels has over 20 years experience of understanding Polarized Light Microscopy (PLM) and its application to crystalline materials. Mr. Daniels understands what measurements are possible with a Polarized Light Microscope, how they are performed, and how to form conclusions about the identity of a component from the measurements. Mr. Daniels is capable of measuring all optical properties required for the identification of regulated asbestos types, and in particular, the index of refraction by the immersion method.

Analyst

Major Function: Preparation and analysis of suspect asbestos containing building materials.

Responsibilities:

1. Receiving.
2. Sample log in.
3. Preparation.
4. Analysis.
5. Form completion.
6. Final form documentation.
7. Data entry.

Optional Responsibilities:

1. Billing / Invoicing.
2. Purchasing consumables.
3. Instrument calibration.
4. Organization of lab activities.
5. Transmission of results.
6. In house air monitoring.
7. Cleaning lab / wet wipe.

Qualifications: High school graduate preferably 1-2 years college course work with emphasis in basic sciences.
Laboratory understudy for - minimum 2 years to ensure the individual analyst is proficient in performing analytical duties such as CVES (Calibrated Visual Estimations) utilizing the Stereo Microscope and identification of 7 optical properties utilizing the Polarized Light Microscope (PLM).

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Equipment & Reference Material

Mid Atlantic maintains and utilizes the following equipment for Polarized Light Microscopy (PLM) analysis:

- ST100 Stereo Microscope
- Leitz Laborlux Polarized Light Microscope
- Hazard Technology Biohazard Hood
- Cargille Refractive Index Liquids (Dispersion Staining Oils)
- Dwyer Vaneometer (Hood Velocity Readings)
- Periplan Highpoint Eyepiece 10x / 18M (Point Counting)
- Sampling Utensils (tweezers, razors, knives, forceps, probe needles, etc..)
- Sample Containers (glassine paper, Petri dishes, etc…)
- Microscope Slides & Coverslips
- Refractive Index Liquids (1.490-1.570, 1.590-1.720 in increments of less than or equal to 0.005)
- Mortar & Pestle
- Thermometer
- Refractometer
- Thermolyne 1500 Furnace (Sybron)
- Hydrochloric Acid

Mid Atlantic utilizes the following reference material for Polarized Light Microscopy (PLM) analysis:

- NIST – Traceable standards for the major asbestos types
- Proficiency Analytical Testing Samples (AIHA)
- McCrone Research Institute Training Material (books)
- Optical Mineralogy (book by Paul Kerr)
- Optical Mineralogy Theory & Techniques (book by Ernest Ehlers)
- U.S. Environmental Protection Agency "Interim Method for the Determination of Asbestos in Bulk Insulation Samples"
- "Asbestos-Containing Materials in Schools; Final Rule and Notices," as found in 40 CFR, Part 763, Subpart E
- U.S. Environmental Protection Agency "Method for the Determination of Asbestos in Bulk Building Materials" (EPA/600/R-93/116), July 1993
- NIST Handbook 150

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Measurement, Traceability & Calibration

Mid Atlantic ensures measurement accuracy and precision by the use of standards, such as samples from past proficiency testing rounds, past EPA Asbestos Bulk Sample Analysis Quality Assurance Program testing samples (quantification of these was determined by consensus so reported quantities may not reflect actual amounts), or samples that have been well characterized by intra- and interlaboratory testing and alternate methods of analysis. Specific preparation techniques as found in Appendix C of the U.S. EPA "Method for the Determination of Asbestos in Bulk Building Materials" may be used for the preparation and characterization of samples to be used as standards.

The precision and accuracy of the analyses shall be determined by Mid Atlantic on the types of samples received for analysis. Precision describes the ability to repeat a measurement, and accuracy describes the correctness of a measurement. Precision can be determined routinely by comparing results of a single sample from multiple analysts and/or from multiple analyses by the same analyst. The precision in the quantitative analysis of a sample by a single analyst is typically defined by the variation observed among multiple slides prepared from the sample or through blind reanalysis of a particular sample. Accuracy will be determined using materials of known concentration, such as past proficiency testing materials, prepared standards (in-house or purchased), or materials analyzed by an independent technique.

The accuracy of the technique is dependent on the amount of asbestos in the sample and the characteristics of the matrix; this should be recognized by the laboratory and provisions for such, incorporated into the quality system. An example of the variability that can be expected with concentration is given in the U.S. EPA "Method for the Determination of Asbestos in Bulk Building Materials." Standards that are available for quantitative asbestos analysis such as typical manufactured standards give the concentration of asbestos in units of weight percent; however, the PLM technique yields results in units of relative area. The conversion of weight percent to area percent requires knowledge of the density and relative grain size of the components of the sample-factors that are often not easily determined. However, difference between weight percent and area percent is often obscured by the semi-quantitative nature of the PLM technique, and for many samples there is no significant difference between weight and area percent results. The exceptions to this statement occur when the sample contains components (such as organic materials) that have a very different density than the asbestos minerals or when there is a large disparity in relative grain size. It is recommended that laboratories use weight percent and point-counted standards when training an analyst for quantification of asbestos by PLM technique.

When reporting the percentage of asbestos in a sample, the following considerations will be taken:

1) The asbestos phase(s) must be positively identified by polarized light microscopy and the optical parameters recorded before stating that asbestos is present in any quantity, including trace.

2) The reported quantity of asbestos, including trace, should be consistent on the slide mounts used for quantification. This assumes that the sample is reasonably homogeneous or has been homogenized to ensure that each subsample is representative of the composition of the total sample

3) A point count or equivalent method is required for quantification. If asbestos is counted during the point count, the percentage should be reported; if asbestos is consistently observed but not counted, trace should be reported; if no consistent quantity of asbestos is observed, zero concentration should be reported. Trace is considered to be a quantity of asbestos that is above the laboratory's detection limit and below their limit of quantification.

   The detection limit for asbestos is a function of the analyst's capabilities, the laboratory's reliable blank level, and the visibility of asbestos. The visibility of asbestos is a function of microscope image contrast and resolution, asbestos fiber size, sample matrix, slide preparation, etc. The level of quantification may be defined as the concentration at which a statistical uncertainty may be determined for the quantity of asbestos reported. The uncertainty may be determined by analysis of standard materials and is a function of the same parameters listed for the limit of detection. If a method other than the point count is used for quantification, the level of quantification for the method must be determined and documented by the laboratory in order to report the presence of a trace of asbestos.

Calibration of Test Method

The laboratory will use the test method contained in the U.S. EPA "Interim Method for Determination of Asbestos in Bulk Insulation Samples" or the current U.S. EPA method for analysis of asbestos in building material. The laboratory must have written procedures that describe how the method is implemented in the laboratory. The laboratory is responsible for ensuring that it implements the latest revision of the method. The laboratory shall conform in all respects with the test method except when a departure becomes necessary for technical reasons. The laboratory shall have data to demonstrate the departures from the test method do not detract from the expected precision or accuracy of the measurement. Laboratories utilizing departures from a test method shall have written procedures detailing how the analysis is conducted. These procedures shall include criteria to determine when such departures are warranted

To document the positive identification of asbestos in a sample, the analyst shall record the average optical properties for the population of each asbestos type, including morphology, color and pleochroism, indices of refraction, birefringence, extinction characteristics, sing of elongation, and any other distinguishing characteristic observed.

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Records

For protection from liability and considering possible future requirements, Mid Atlantic Environmental Consultants, Inc., retains copies of all analytical data for a retention period of 3 years from the data of analysis. If a longer period of retention is required by the client, regulation, or the laboratory's own procedure, the records will then be archived for a period of 3 more years.

The records to be maintained include:

1) Sample custody records
2) Original data collected, signed (or initialed), and dated by analyst- (if applicable)
3) Contamination monitoring data
4) Calibration and verification data
5) Data and results of quality control
6) Equipment and maintenance records
7) Test reports

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Final Reports

Mid Atlantic adheres to testing report requirements found in the NIST Handbook. The following information will be required to be documented for each individual sample analysis.

1) Presence or absence of asbestos and identification of each asbestos type

2) Calibrated visual estimation (CVES) utilizing a stereo microscope for each type of asbestos present

3) All multiple layered samples will be segregated and analyzed separately and reported as such (if feasible) in accordance with 40CFR Part 61

4) Identity and area percentage of other fibrous and matrix materials (if achievable)

5) Color and macroscopic description and any other pertinent information that serves to identify and describe the specific sample

**All sub-contracted analytical work will be performed by laboratories that meet all the requirements of the NIST (National Institute of Standards & Technology) Handbook.*

APPENDIX C

HEALTH AND SAFETY PLANS

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
HEALTH AND SAFETY PLAN – MACHINE SHOP PROPERTY
PHASE II INVESTIGATION

Project Hazard Assessment Form and Safety Plan

Client:	Business Development Corporation of the Northern Panhandle	Project No:	164-123
Location:	Machine Shop Property, Weirton, WV	Project Start Date:	May 29, 2017

- This Project Hazard Assessment (PHA) is required for all projects with field operations.
- The Project Safety Plan (PSP) is to include the safe operating procedures prepared to assist in mitigating the identified project hazards
- This completed form must be filed in the Project Management/Safety folder.

1. Scope of Service:

Phase I and II ESAs, Community Relations, and Site Planning related to USEPA Brownfields Assessment Grant
Note: include the services to be provided by CEC employees and any subcontractors that are under the control of CEC.

This PSP was prepared for the use of CEC personnel while performing the following tasks:

1.1 Task 2H2C: 2.H.2.C Phase II ESA – Machine Shop

All work plans/scopes referenced in this PSP will be available for CEC personnel on site. The CEC field staff may also call the Project Manager.

It is the purpose of this PSP to proactively aid CEC employees in:

- Identifying and understanding the risks/hazards they are likely to encounter at the site.
- Mitigating those risks/hazards.

2. General

Does a Prime Contractor (Constructor) or Client Safety Program apply? ☐ Yes ☒ No

If yes, all project team members working in the field are required to receive client safety training. Append copy of client documentation to this form.

3. Approvals

Prepared by:	Amanda Gladowski		
	Print Name	Signature	Date
Approved by:	Dave Olson		

4. Hazard Identification, Evaluation, and Control

Hazard (or Potential Hazard) Description:	HAZARD PRESENT/ EXPECTED?	Appropriate Control Measure(s):	PPE/Safety Equipment Beyond CEC Standard Required:
ENVIRONMENTAL HAZARDS			**Section N/A?** ☐
Noise	☐ Yes ☒ No	WSM400.7 Noise Exposure and Hearing Conservation	Foam ear plugs with a min. 29 NRR
Animal/Vegetation Environmental Encounters	☒ Yes ☐ No	WSM100.4 Domestic and Wild Animal Safety WSM100.18 Poisonous Snakes, Insects, and Plants WSM200.19 Hand Removal of Vegetation WSM200.37 Bat Handling	Gloves: Leather/Canvas/ Nitrile as appropriate Tick Test Kit/Tick Key Tick Repellent/Duct Tape/Technu
Uneven ground, foot-level debris, potential injury to foot, walking obstructions, level, or tripping hazards	☒ Yes ☐ No	WSM100.9 Geographic Hazards	Proper ANSI footwear to be worn at all times: Steel toed boots with steel shank or hiking boot as appropriate
Over-head construction / operation/ Head-level obstructions	☐ Yes ☒ No	WSM200.36 Working Near Overhead High-Voltage Lines	ANSI approved Type I, Class E Hard Hat
Working in Open Excavations	☐ Yes ☒ No	WSM200.13 Excavation, Trenching & Shoring	Appropriate fall protection/prevention system.
High voltages / live overhead power lines or equipment	☐ Yes ☒ No	WSM200.36 Working Near Overhead High-Voltage Lines	ANSI approved Type I, Class E Hard Hat Non-conductive ladder
Work from unprotected heights	☐ Yes ☒ No	WSM200.30 Flat Roof Fall Protection WSM400.8 Fall Protection Program	Fall Arrest Harness, Fall Protection System
Work in boats or by/on a body of water (excludes walking along streams with no hazard of falling in)	☐ Yes ☒ No	WSM200.18 Electro Shocking from Boats WSM200.35 Working In or Around Water WSM300.8 Work Boats	Personal Flotation Device
Extreme Weather Temperatures / Conditions: • Heat • Cold • Inclement weather conditions • Sun	☒ Yes ☐ No	WSM100.3 Cold Weather Safety WSM100.12 Hot Weather Safety WSM100.14 Inclement Weather Safety WSM100.19 Sun Exposure WSM100.21 Wet Weather Safety	Appropriate clothing
Working Alone	☒ Yes ☐ No	WSM100.31 Working Alone	Appropriate for project hazards SPOT Satellite GPS or Cell Phone/Booster as appropriate

Hazard (or Potential Hazard) Description:	HAZARD PRESENT/ EXPECTED?	Appropriate Control Measure(s):	PPE/Safety Equipment Beyond CEC Standard Required:
Work on Construction Sites (excludes work/ walking around the perimeter of Construction Sites	☐ Yes ☒ No	WSM200.2 Construction Sites WSM200.41 Construction Site Testing Safety	Appropriate for project hazards
Work in Confined Spaces	☐ Yes ☒ No	WSM200.3 Confined Space Entry	To be Identified during Confined Space assessment.
PEOPLE HAZARDS			**Section N/A?☐**
Hostile or Irate People	☐ Yes ☒ No	WSM100.11 Hostile & Irate People Safety Practices	N/A
Working near or around construction traffic	☒ Yes ☐ No	WSM200.17 Earth Moving Activities	Traffic Safety Vest Safety Lights if appropriate
Working near or around Traffic	☐ Yes ☒ No	WSM200.23 Work Zone Safety / Traffic Control WSM200.24 Flagging Traffic	Class 2 or 3 High Visibility Traffic Safety Vests as appropriate. Control signage and devices as required. Safety Lights if appropriate.
EQUIPMENT HAZARDS			**Section N/A?☐**
Work / inspection on raised platforms / sky jacks	☐ Yes ☒ No	WSM200.28 Access to Stack Testing Locations WSM200.29 Annular Air Sampling Locations WSM200.32 Work Platform Safety – Scaffolds WSM300.11 Man-Lift Use WSM400.8 Fall Protection Program	Fall Arrest Harness, Fall Protection System
Ladders or climbing	☐ Yes ☒ No	WSM300.1 Ladders WSM400.8 Fall Protection Program	Fall Arrest System
Operation of Construction Equipment	☐ Yes ☒ No	WSM100.5 Equipment Mounting and Dismounting WSM200.17 Earth Moving Activities WSM300.2 Fork Lifts WSM300.15 Mobile Equipment WSM300.16 Vacuum Truck Operations	Appropriate for project hazards
Hoisting Equipment	☐ Yes ☒ No	WSM200.31 Hoisting Equipment	Appropriate for the operations
Electrical Equipment	☐ Yes ☒ No	WSM200.1 Lockout/Tagout WSM100.28 Electrical Safety WSM300.10 Extension Cords	Gloves: Electrical protective Hard Hat: Class E Clothing: Arc Flash Clothing
Process Pipe Systems	☐ Yes ☒ No	WSM200.40 Linebreaking	Appropriate for the operations

Hazard (or Potential Hazard) Description:	HAZARD PRESENT/ EXPECTED?	Appropriate Control Measure(s):	PPE/Safety Equipment Beyond CEC Standard Required:
Vehicle Operation	☒ Yes ☐ No	WSM100.20 Vehicle Operation WSM100.22 Use of Mobile Electronics While Driving WSM300.3 Field Vehicles WSM300.12 All-Terrain Vehicle - Quad/Four Wheeler WSM300.13 Trailer Use	Seat Belt Helmet as required Gloves, glasses, and training as required by WSM300.12
Hand and Portable Power Tools	☒ Yes ☐ No	WSM300.6 Hand Tools (Power and Manual) WSM300.7 Posthole Diggers Gas Powered Augers	Gloves: Leather/Canvas/ Nitrile as appropriate and/or recommended by tool manufacturer.
Cutting Tools	☐ Yes ☒ No	WSM300.9 Chain Saws and All-Purpose Cut-off Saws WSM300.14 Machete Use - Trail Clearing	Gloves: Cut Resistant
Nuclear Densometer Usage	☐ Yes ☒ No	WSM400.6 Radiation Safety Program WSM200.41 Construction Site Testing Safety	
Unusual circumstances / active processes: welding, cutting, etc.	☐ Yes ☒ No	WSM100.7 Fire Safety WSM200.39 Welding, Cutting, and Hot Work WSM300.17 Fire Extinguishers - Fire Protection	Appropriate for project hazards
CHEMICAL HAZARDS **(Attach copy of appropriate Safety Data Sheets to this document if applicable)**			**Section N/A?** ☐
Asbestos	☐ Yes ☒ No	WSM400.11 Working with Asbestos-Containing Materials	Gloves: Nitrile Respirator: Air purifying respirator or powered air purifying respirator with high efficiency particulate filter Clothing: Washable or disposable coveralls Boots: Rubber boot covers
Benzene	☒ Yes ☐ No	WSM100.29 Benzene Awareness WSM100.10 Hazardous Materials WSM400.1 Hazard Communication Program	Gloves: Nitrile Respirator: Full face with Organic Vapor Cartridges* Clothing: Chemical-resistant coveralls Boots: Chemically-resistant boots Eyes: Goggles and faceshield (if respirator is not required * Dependent on concentration

Hazard (or Potential Hazard) Description:	HAZARD PRESENT/ EXPECTED?	Appropriate Control Measure(s):	PPE/Safety Equipment Beyond CEC Standard Required:
Hydrogen Sulfide (H2S)	☐ Yes ☒ No	WSM100.36 Gas Hazard Awareness WSM100.30 Hydrogen Sulfide (H2S) WSM100.10 Hazardous Materials WSM400.1 Hazard Communication Program	Gloves: Butyl rubber, chlorinated polyethylene, neoprene nitrile, or polyvinyl rubber Respirator: Up to 100 ppm: Powered air purifying respirator with acid gas cartridges; or gas mask with acid gas cartridges. >100 ppm: SCBA Clothing: Chemical-resistant coveralls Boots: Chemically-resistant
Lead	☒ Yes ☐ No	WSM400.9 Lead Health & Safety Program WSM100.10 Hazardous Materials WSM400.1 Hazard Communication Program	Gloves: Nitrile Respirator: Air purifying respirator or powered air purifying respirator with high efficiency particulate filter * Clothing: Washable or disposable coveralls Boots: Rubber boot covers * Dependent on concentration
Radiation	☐ Yes ☒ No	WSM100.32 Naturally Occurring Radioactive Materials (NORM) WSM400.6 Radiation Protection Program	Gloves: Nitrile Respirator: Air purifying respirator or powered air purifying respirator with high efficiency particulate filter * Clothing: Washable or disposable coveralls Boots: Rubber boot covers * Dependent on concentration
Pesticides and Herbicides	☐ Yes ☒ No	WSM400.12 Safe Handling and Application of Pesticides and Herbicides	Clothing: Long sleeve shirt, pants, and socks. Spray drift suit (when boom spraying and exposure is likely) Gloves: Appropriate chemical resistant gloves Boots: Rubber boot covers Respirator (when required by the pesticide/herbicide SDS)
Compressed Gasses	☐ Yes ☒ No	WSM100.36 Gas Hazard Awareness WSM300.4 Compressed Gas Cylinders WSM300.5 Gas Regulators	Appropriate for Specific Chemical. Refer to SDS
Waste Materials	☐ Yes ☒ No	WSM200.14 Waste Materials Handling & Storage WSM200.22 Solid Waste Landfill Operations	Appropriate for Specific Chemical. Refer to SDS

Hazard (or Potential Hazard) Description:	HAZARD PRESENT/ EXPECTED?	Appropriate Control Measure(s):	PPE/Safety Equipment Beyond CEC Standard Required:
Other chemical Hazard – Specify: PCBs	☒ Yes ☐ No	WSM100.10 Hazardous Materials WSM400.1 Hazard Communication Program WSM100.36 Gas Hazard Awareness	Appropriate for Specific Chemical. Refer to SDS
Other chemical Hazard – Specify: Click here to enter text.	☐ Yes ☒ No	WSM100.10 Hazardous Materials WSM400.1 Hazard Communication Program WSM100.36 Gas Hazard Awareness	Appropriate for Specific Chemical. Refer to SDS
Airborne dust / debris	☐ Yes ☒ No	WSM400.1 Hazard Communication Program WSM100.10 Hazardous Materials WSM400.1 Hazard Communication Program	Half or full face respirator with particulate filters
Explosion hazards (ex: combustible / explosive gases / dusts / stored substances)	☐ Yes ☒ No	WSM400.1 Hazard Communication Program WSM100.10 Hazardous Materials WSM400.1 Hazard Communication Program	Appropriate for other project hazards
OTHER HAZARDS			
Geologic Field Hazards	☐ Yes ☒ No	WSM200.5 Geologic Field Mapping	Appropriate for project hazards
Lifting	☐ Yes ☒ No	WSM100.15 Lifting Safety	Appropriate for project hazards
Survey Work	☐ Yes ☒ No	WSM200.4 Survey Activities	Appropriate for project hazards
Working Near Rail Lines	☐ Yes ☒ No	WSM200.38 Rail Line Safety	Appropriate for project hazards

5. List of Project Specific Hazards and Required Controls

To be completed as required by the Project Manager and field staff to address additional hazards not listed in the above Table. Complete JHA form in accordance with WSM100.23.

Hazard (or Potential Hazard) Description	HAZARD PRESENT/ EXPECTED?	Appropriate Control Measure(s)	PPE Required
Overseeing shallow excavation	☒ Yes ☐ No	Stay clear of excavator, maintain communication with operator, maintain line of sight with operator	High visibility vest, hard hat, steel toe boots, safety glasses
Click here to enter text.	☐ Yes ☐ No	Click here to enter text.	Click here to enter text.
Click here to enter text.	☐ Yes ☐ No	Click here to enter text.	Click here to enter text.

6. Personal Protective Equipment

Based on the above tables, identify the required Personal Protective Equipment below:

PPE	Type
☒ Hard Hat	☒ Standard ☐ ANSI Class E
☒ Work Boots	☒ Steel Toe ☐ Metatarsal Guard ☐ Hiking
☒ Eye/Face Protection	☒ Safety Glasses ☐ Goggles ☐ Face Shield
☒ High Visibility Vest	☒ Class 1 ☐ Class 2 ☐ Class 3
☒ Gloves	Type: Nitrile

PPE	TYPE
☐ Hearing Protection	NRR Rating: Click here to enter text.
☐ Respiratory Protection	☐ Half-Face ☐ Full-Face Cartridge: Click here to enter text.
☐ Clothing/ Apparel	☐ Flame Retardant ☐ Chemical ☐ Other: Click here to enter text.
☐ Fall Protection	Type: Click here to enter text.
Other:	Type: Click here to enter text.

7. Air Monitoring Specifications ☒ NA

If air monitoring is required, complete the table below:

Instrument ID	Contaminant	Results (units)	PEL/TLV/ Action Level	Time	Calibration Date

8. Does the project require site control/decontamination? If so, describe below. ☐ NA

Excavated soil will be disposed offsite in accordance with applicable laws and regulations.

9. Emergency Information

Emergency Numbers

a. Note: 911 is not always the appropriate number – please verify. May need to include a site specific emergency contact number identified by the client.
b. For all symptoms of work-related injury/illness, contact AllOne Health: 1-800-350-4511

Site Emergency No.	Not applicable	Fire Department	911
Ambulance	911	Police	911
Hospital	(304) 797-6000	Environment Dept.	(304) 926-0440
Poison Control	800-222-1222	INFOTrac	800-535-5053

DIRECTIONS AND MAP TO THE HOSPITAL – Weirton Medical Center **HOSPITAL**

See attached.

It is the responsibility of the Project Manager to prepare and communicate the requirements of the PSP to all field staff. Include client-required protocols, where required, as an attachment to this plan.

Project Personnel Numbers:

Title	Name	Company	Phone Number
Project Manager	Elizabeth Stas	Civil & Environmental Consultants, Inc.	(724) 493-7073
Project Site Safety	Not applicable	Not applicable	Not applicable
Client or Owner	Patrick Ford	Business Development Corporation of the Northern Panhandle	(304) 748-5041
Other:	Not applicable	Not applicable	Not applicable

First Aid facilities are located:	CEC vehicle
First Aiders on site are:	CEC employees
Fire extinguishers are located:	CEC vehicle
Emergency/Fire alarms are located:	Not applicable
Safety Data Sheets are located:	Not applicable
Spill response equipment is:	Not applicable
The nearest phone is:	Personal cell phone

Record Site-Specific Information Below (Evacuation Signal, Muster Points, Etc.)

Not applicable

Environmental Incidents

For incidents involving spills, releases or other negative impacts to air, water, land, animals etc.:

(1) If possible, and safe to do so, stop the spill or release and prevent further damage.
(2) Take notes and photographs if possible. An investigation may be required.
(3) Complete and submit an Accident Incident Report (AIR) immediately using the OTHER category.

Other Incidents

For incidents involving serious injury, a fatality, or major property damage:

(1) Notify local Office Leader and Corporate Safety Director immediately. Discuss with proper authorities only.
(2) Do not disturb the scene except to tend to the injured and prevent further damage.
(3) Take notes and photographs if possible. An Incident Report is to be prepared and submitted immediately.

** DO NOT CALL REGULATORY AUTHORITIES DIRECTLY**

10. Have The CEC Workers Involved In The Project Been Advised What To Do In The Following Situations:

	Yes	N/A
Discovery of contaminants or contaminated materials?	☒	☐
Contact with hazardous materials or wastes?	☒	☐
Releases to the environment (air, land or water)?	☒	☐
Responding to requests for on-site advice regarding environmental matters?	☒	☐

11. Are There Any Special Environmental, Health Or Safety Concerns Or Equipment Required?

☐ **Yes** ☒ **No**

If Yes, note concerns or equipment here:
Click here to enter text.

12. Do Workers Require Any Medical Monitoring/Surveillance?

☐ **Yes** ☒ **No**

If Yes, note the protocols that are required and date completed below.

Protocol	Date Completed	
Asbestos	Click to select date.	☐ **NA**
Respirator	Click to select date.	☐ **NA**
HAZMAT	Click to select date.	☐ **NA**
Heavy Metals	Click to select date.	☐ **NA**
Pesticides	Click to select date.	☐ **NA**

13. Do Workers Require Any Special Training?

☒ **Yes** ☐ **No**

If Yes, note the training that is required and date completed below.

Name	Training	Date Completed
Click here to enter text.	OSHA HAZWOPER	Click to select date.
Click here to enter text.	OSHA HAZWOPER	Click to select date.
Click here to enter text.	OSHA HAZWOPER	Click to select date.
Click here to enter text.	OSHA HAZWOPER	Click to select date.

14. Do Workers Require A Site Orientation?

☐ **Yes** ☒ **No**

If Yes, provide the names of the employees and date the orientation was completed.

Employee Name	Orientation Completion Date
Click here to enter text.	Click to select date.
Click here to enter text.	Click to select date.
Click here to enter text.	Click to select date.
Click here to enter text.	Click to select date.
Click here to enter text.	Click to select date.
Click here to enter text.	Click to select date.
Click here to enter text.	Click to select date.

If Client, Prime Contractor Or Constructor Provides Orientation And/Or Training, Attach A Copy Of The Training Record To The Project File.

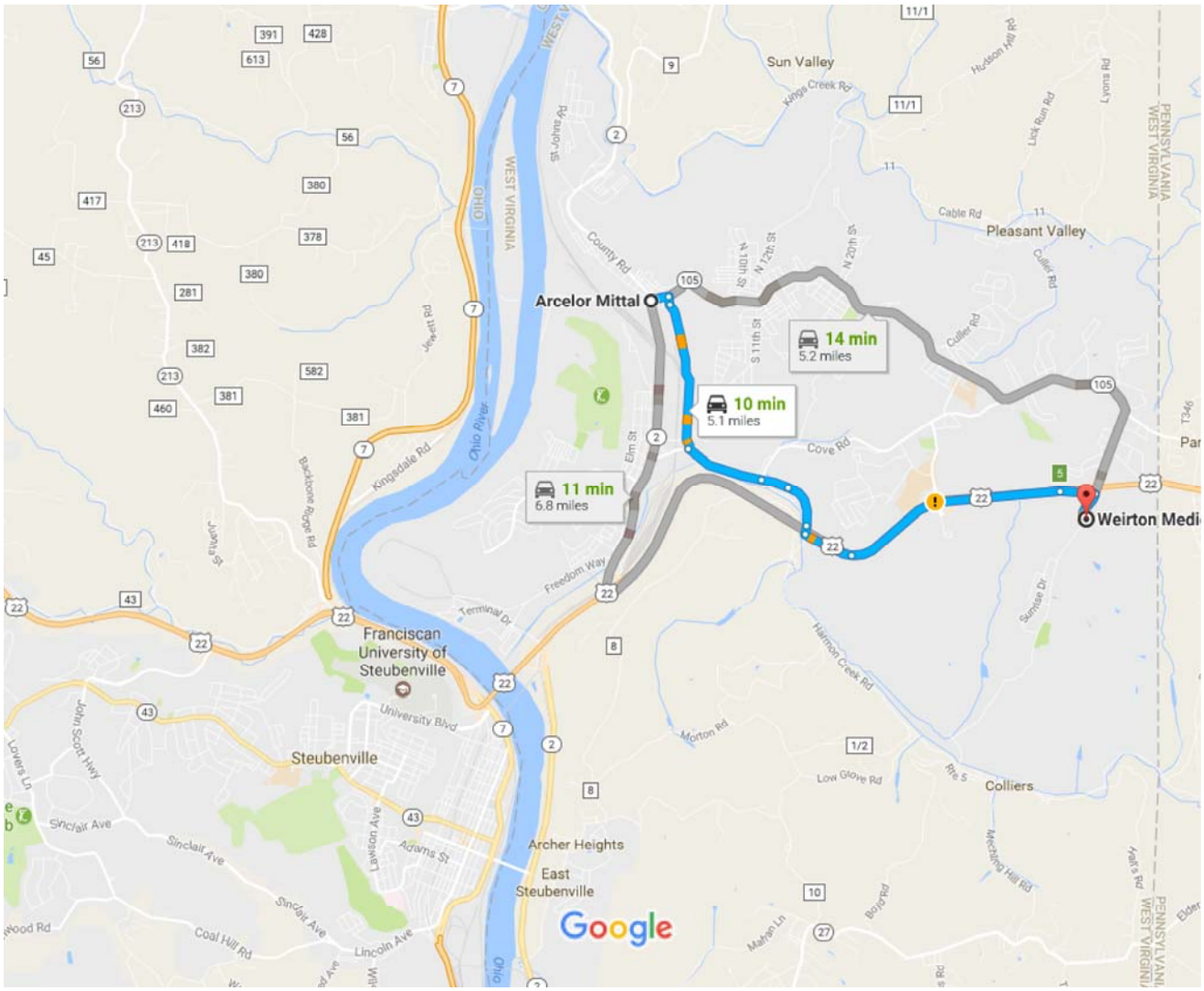
Not applicable

15. Employee Review

All employees required to perform work on this project shall review this Project Hazard Assessment and sign below acknowledging that they have been advised of the hazards and the controls and PPE required. Field conditions affecting hazards may differ from those summarized in this Project Hazard Assessment and must be re-evaluated and any new hazards identified, mitigated, and documented on a daily basis using the Daily Field Hazard Reassessment form. Employees in the field who identify additional hazards not listed above shall notify the project manager of the hazard and confirm the controls that will be used prior to proceeding.

Reviewed by:			
	Print Name	Signature	Date
	Print Name	Signature	Date
	Print Name	Signature	Date
	Print Name	Signature	Date
	Print Name	Signature	Date

Google Maps Arcelor Mittal to Weirton Medical Center Drive 5.1 miles, 10 min



Map data ©2017 Google 1 mi

Arcelor Mittal

100 Pennsylvania Ave, Weirton, WV 26062

1. Head east on Pennsylvania Ave toward Delaware Ave

24 s (0.1 mi)

Follow Weir Ave to Cove Rd

3 min (1.2 mi)

2. Turn right onto Weir Ave

351 ft

3. Turn left to stay on Weir Ave

1.1 mi

4. Turn left onto Cove Rd

1 min (0.6 mi)

Get on US-22 E in Weirton from Harmon Creek Rd/Old US Hwy 22

2 min (1.0 mi)

5. Continue straight to stay on Cove Rd

0.2 mi

6. Continue onto Harmon Creek Rd/Old US Hwy 22

0.3 mi

7. Continue onto Cove Rd

377 ft

8. Turn left to merge onto US-22 E

0.4 mi

Continue on US-22 E to Colliers Way. Take exit 5 from US-22 E

2 min (1.9 mi)

9. Merge onto US-22 E

1.7 mi

10. Take exit 5 for West Viginia 105/Colliers Way

0.3 mi

Follow Colliers Way to your destination

1 min (0.2 mi)

11. Turn right onto Colliers Way

0.2 mi

12. Turn left

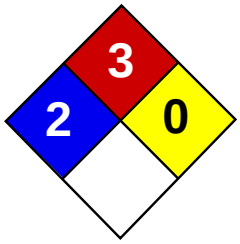
Destination will be on the right

105 ft

Weirton Medical Center

601 Colliers Way, Weirton, WV 26062

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C6-H6

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Benzene	71-43-2	100

Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. The substance is toxic to blood, bone marrow, central nervous system (CNS). The substance may be toxic to liver, Urinary System. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor. Vapor may cause flash fire. Reacts on contact with iodine heptafluoride gas. Dioxygenyl tetrafluoroborate is as very powferful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition. Contact with sodium peroxide with benzene causes ignition. Benzene ignites in contact with powdered chromic anhydride. Virgorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

Special Remarks on Explosion Hazards:
Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction

of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States] TWA: 1.6 STEL: 8 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.1 STEL: 1 from NIOSH TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States] TWA: 10 (ppm) from OSHA (PEL) [United States] TWA: 3 (ppm) [United Kingdom (UK)] TWA: 1.6 (mg/m3) [United Kingdom (UK)] TWA: 1 (ppm) [Canada] TWA: 3.2 (mg/m3) [Canada] TWA: 0.5 (ppm) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:
Aromatic. Gasoline-like, rather pleasant. (Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

pH (1% soln/water): Not available.

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 930 mg/kg [Rat]. Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. Causes damage to the following organs: blood, bone marrow, central nervous system (CNS). May cause damage to the following organs: liver, Urinary System.

Other Toxic Effects on Humans:
Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects. May affect genetic material (mutagenic). May cause cancer (tumorigenic, leukemia)) Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism,and urinary system. Eyes: Causes eye irritation. Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system. Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value) California prop. 65: This product contains the following ingredients

for which the State of California has found to cause cancer which would require a warning under the statute: Benzene Connecticut carcinogen reporting list.: Benzene Connecticut hazardous material survey.: Benzene Illinois toxic substances disclosure to employee act: Benzene Illinois chemical safety act: Benzene New York release reporting list: Benzene Rhode Island RTK hazardous substances: Benzene Pennsylvania RTK: Benzene Minnesota: Benzene Michigan critical material: Benzene Massachusetts RTK: Benzene Massachusetts spill list: Benzene New Jersey: Benzene New Jersey spill list: Benzene Louisiana spill reporting: Benzene California Director's list of Hazardous Substances: Benzene TSCA 8(b) inventory: Benzene SARA 313 toxic chemical notification and release reporting: Benzene CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer. R62- Possible risk of impaired fertility. S2- Keep out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S46- If swallowed, seek medical advice immediately and show this container or label. S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:35 PM

Last Updated: 05/21/2013 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

MATERIAL SAFETY DATA SHEET

(POLYCHLORINATED BIPHENYLS)

COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients Name: polychlorinated biphenyls (PCBs)

HAZARD IDENTIFICATION

Reports of Carcinogenicity: YES

HEALTH HAZARDS ACUTE AND CHRONIC

- **Eyes**: Moderately irritating to eye tissues.
- **Skin**: Can be absorbed through intact skin, may cause de-fatting, potential for chloracne.
- **Inhalation**: Possible liver injury.
- **Ingestion**: Slightly toxic; reasonably anticipated to be carcinogenic.

EFFECTS OF OVER-EXPOSURE

Can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

FIRST AID MEASURES

- **Eyes**: Irrigate immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them.
- **Skin:** Contaminated clothing should be removed and the skin washed thoroughly with soap and water. Hot PCBs may cause thermal burns.
- **Inhalation**: Remove to fresh air; if skin rash or respiratory irritation persists, consult a physician (if electrical equipment arcs over, PCBs may decompose to produce hydrochloric acid).
- **Ingestion**: Consult a physician. Do not induce vomiting or give any oily laxatives. (If large amounts are ingested, gastric lavage is suggested).

FIRE FIGHTING MEASURES: Flash Point: >141 ^{o}C (285.8 ^{o}F)

EXTINGUISHING MEDIA: PCBs are fire-resistant compounds.

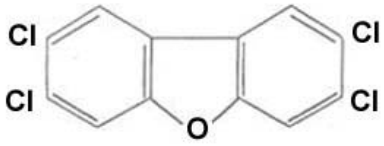
FIRE-FIGHTING PROCEDURES

Standard fire-fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

UNUSUAL FIRE/EXPLOSION HAZARD

If a PCB transformer is involved in a fire-related incident, the owner of the transformer is required to report the incident. Consult and follow appropriate federal, provincial and local regulations.

***Note**: When askarel liquid becomes involved in a fire, toxic by-products of combustion are typically produced including polychlorinated dibenzofurans and polychlorinated dibenzodioxins, both known carcinogens. The structures of these chemical species are as follows:*

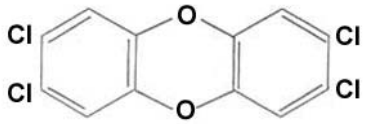


TCDF

$C_{12}H_{8-n}Cl_nO$

$n = 4 - 8$

2,3,7,8-tetrachlorodibenzofuran



TCDD

$C_{12}H_{8-n}Cl_nO_2$

$n = 4 - 8$

2,3,7,8-tetrachloro-dibenzo-p-dioxin

***Note**: 2,3,7,8-tetrachloro-dibenzo-p-dioxin is one of the most potent teratogenic, mutagenic and carcinogenic agents known to man.*

SPILL RELEASE PROCEDURES

Cleanup & disposal of liquid PCBs are strictly regulated by the federal government. Ventilate area. Contain spill/leak. Remove spill by means of absorptive material. Spill clean-up personnel should use proper protective clothing. All wastes and residues containing PCBs should be collected, containerized, marked and disposed of in the manner prescribed by applicable federal, provincial and local laws.

HANDLING AND STORAGE PRECAUTIONS

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid. Avoid prolonged breathing of vapours or mists. Avoid contact with eyes or prolonged contact with skin. Comply with all federal, provincial and local regulations.

OTHER PRECAUTIONS

Federal regulations require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be appropriately labelled.

RESPIRATORY PROTECTION

Use OHSA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. The respirator use limitations specified by the manufacturer must be observed.

VENTILATION

Provide natural or mechanical ventilation to control exposure levels below airborne exposure levels.

PROTECTIVE GLOVES: Wear appropriate chemical resistant gloves to prevent skin contact.

EYE PROTECTION: Wear chemical splash goggles and have eye baths available.

OTHER PROTECTIVE EQUIPMENT

Wear appropriate protective clothing. Provide a safety shower at any location where skin contact can occur.

WORK HYGIENIC PRACTICES

Wash thoroughly after handling. Supplemental safety and health : none

PHYSICAL/CHEMICAL PROPERTIES

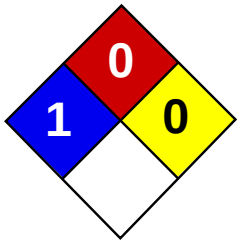
- **Vapour pressure:** (mm Hg @100 ^{o}F) 0.005 - 0.00006
- **Viscosity:** (CENTISTOKES) 3.6 - 540
- **Stability indicator/materials to avoid:** Yes
- **Stability Condition to Avoid:** PCBs are very stable, fire-resistant compounds.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide, hydrogen chloride, phenolics, aldehydes, furans, dioxins

WASTE DISPOSAL METHODS

Consult the applicable PCB regulations prior to any disposal of PCBs or PCB-contaminated items.



Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m3) from OSHA (PEL) [United States] TWA: 0.03 (mg/m3) from NIOSH [United States] TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

pH (1% soln/water): Not applicable.

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually abssorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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GENERAL SAFE OPERATING PRACTICES

DOMESTIC AND WILD ANIMALS WSM100.4

Field employees are at risk from exposure to various types of animals, their nests, waste products and their carcasses. Rodents and other animals can harbor disease causing agents that are very harmful to humans. Care should be taken to avoid all wild animals and domestic animals that have the potential to harm you.

To avoid accident or injuries associated with rodents and other animals observe the following guidelines:

1. Be aware of your surroundings and note any wild or suspicious acting animals in your work area. If necessary, seek safe shelter from these animals.

2. Avoid reaching or stepping into or over hidden areas that may contain such animals.

3. When working with soil, be aware of signs that indicate above or below ground animal nests and take appropriate action to prevent contamination by dust or injury from bites.

4. If working around animal carcasses, spray them with a disinfectant (Lysol) prior to removal and wear rubber gloves to remove animal carcasses. Dispose of dead animals in compliance with applicable city or county health guidelines. Wash exposed skin with an antibacterial or disinfectant soap (e.g., Dial or Dermascrub) after removal and disposal of the animal.

5. If an animal bite occurs, clean the wound with soap and water, and follow appropriate first aid procedures. Immediately report the incident to your supervisor.

6. Transport any bite victim to the CEC preferred provider located in your area. (If possible, safely capture or kill the animal so it can be tested for any known disease causing agents.)

7. If exposure to airborne particles and dust from a nest does occur, immediately report the incident to your supervisor. (If possible, and without further exposure to you, mark the site without disturbing it so trained personnel can collect samples to determine if any disease causing agents are present.)

8. Avoid direct contact with bird, bat and other animal droppings. Areas where birds and bats roost should be avoided or appropriate respiratory protection shall be used when working in such an area.

9. Avoid direct contact with animal blood. Wear rubber gloves if contact with animal blood cannot be prevented. Dispose of rubber gloves properly. Wash hands thoroughly with an antibacterial soap after disposal of rubber gloves and before eating, drinking or smoking.

10. When working near farm animals, note their positions, numbers and demeanor.

GEOGRAPHIC HAZARDS

Hazard Review

Uneven Terrain
Swamp Lands/Wetlands
Woodlands
Poisonous Snakes/Insects/Plants
Falling Rocks
Animals

1. Wear appropriate personal protective equipment consistent with the hazard.

2. Be alert for tripping hazards such as loose rocks, logs, hidden objects, holes and uneven ground.

3. If rappelling is necessary, individuals doing rapelling must have successfully completed a rappelling course.

4. Supervisors shall ensure that employees who use rappelling equipment have the necessary training.

5. For climbing on slopes and mountainous terrain, ensure all climbing equipment has sufficient weight ratings for personnel and equipment being used during the climb.

6. Inspect safety lines and equipment prior to rappelling.

7. Be aware of poisonous plants, insects, snakes, animals, and animal waste products and carcasses. Wear long sleeve shirts, gloves and high-top boots when hazards cannot be avoided.

8. Be aware of sink holes and quick sand areas in swamps and coastal plain areas.

9. Be cautious of dead trees and limbs in wooded areas.

10. Be aware of deer and big game hunters during the hunting season. The use of bright orange traffic vests or blaze orange clothing is required when working in wooded areas

11. Review safety procedures relative to area and surroundings.

HAZARDOUS MATERIALS (JOBSITE) WSM100.10

Supervisors

1. Ensure that labels on hazardous materials are legible when the material is received and that they are maintained in a legible condition. Containers should be stored with warning labels visible.

2. Maintain the collection of Material Safety Data Sheets in a good condition and ensure employee access when requested.

3. Provide initial and refresher training on the CEC Hazard Communication Standard and the CEC Hazard Communication Program. Maintain records of employees' training.

4. Ensure employees are provided with and instructed on the use of any personal protective equipment that may be necessary for working with the hazardous materials.

5. Provide proper devices and containers for transfer of hazardous material.

6. Ensure proper labeling on storage buildings that contain hazardous chemicals.

Employees

1. Acquire the necessary training before working with any hazardous material.

2. Review chemical labels for procedures to follow, personal or environmental hazards and safety information.

3. Acquire and wear necessary personal protective equipment before working with any hazardous material.

4. Use approved containers for transporting hazardous material.

5. Arrange for disposal of hazardous materials consistent with applicable Federal, State and local protocols.

6. CEC employees are not permitted to sign hazardous waste manifests.

GENERAL SAFE OPERATING PRACTICES

HOT WEATHER SAFETY WSM100.12

I. INTRODUCTION

Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress. Outdoor operations conducted in hot weather including hazardous waste site activities that require workers to wear PPE are likely to cause heat stress.

TRAINING

Each CEC employee shall be trained to understand methods of preventing heat-related illness, symptoms of heat disorders, how to mitigate heat-related effects, and how to provide emergency response to heat-related illnesses. CEC employees managing the work of others shall be trained as indicated above before assuming supervisor duties. Supervisor training will also include consideration of the individual employee causal factors affecting heat stress prior to the assignment of workers to tasks.

CAUSAL FACTORS

Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension affect sensitivity to heat. It is difficult to predict just who will be affected and when, because individual susceptibility varies.
Environmental factors include ambient air temperature, radiant heat, air movement, conduction, and relative humidity affect an individual's response to heat.

II. HEAT DISORDERS AND HEALTH EFFECTS

HEAT STROKE occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature. If body temperature is too high, it causes death.

If a worker shows signs of possible heat stroke, professional medical treatment is to be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protests, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

HEAT EXHAUSTION. The signs and symptoms of heat exhaustion are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly since fainting associated with heat exhaustion can be dangerous if the victim is operating machinery or the victim may be injured when he or she faints.

Workers suffering from heat exhaustion are to be removed from the hot environment and given fluid replacement. They should also be encouraged to get adequate rest.

HEAT CRAMPS are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Recent studies have shown that drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

HEAT COLLAPSE ("Fainting"). In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable. To prevent heat collapse, the worker should gradually become acclimatized to the hot environment.

HEAT RASHES are the most common problem in hot work environments. Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

HEAT FATIGUE. A factor that predisposes an individual to heat fatigue is lack of acclimatization. The signs and symptoms of heat fatigue include impaired performance of skilled sensorimotor, mental, or vigilance jobs. There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

III. ENVIRONMENTAL HEAT STRESS INDEX ASSESSMENT

The combined effects of ambient air temperature, relative humidity, direct sunlight, and effects of protective clothing can be evaluated using the Heat Stress Index (HSI). The Heat Stress Index is defined using the ambient air temperature and the relative humidity using adjustments for work in direct sunlight and use of protective clothing (see Table 1). The HSI classifies heat stress into five Danger Categories: None, Caution, Extreme Caution, Danger, and Extreme Danger as defined in the table on the following page.

TABLE 1

GENERAL HEAT STRESS INDEX

From the National Weather Service

General Heat Stress Index		
Danger Category	**Apparent Temp. (°F) (Humiture)**	**Heat Syndrome**
IV. Extreme Danger	**>130°**	**Heatstroke or sunstroke imminent**
III. Danger	105°-130°	Sunstroke, heat cramps, or heat exhaustion likely. Heatstroke possible with prolonged exposure and physical activity
II. Extreme Caution	90°-105°	Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and physical activity.
I. Caution	80°-90°	Fatigue possible with prolonged exposure and physical activity

***Note: Degree of heat stress may vary with age, health, and body characteristics**

		Relative Humidity								
		10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Temp °F	**104**	98	104	110	120	**>130**	**>130**	**>130**	**>130**	**>130**
	102	97	101	108	117	125	**>130**	**>130**	**>130**	**>130**
	100	95	99	105	110	120	**>130**	**>130**	**>130**	**>130**
	98	93	97	101	106	110	125	**>130**	**>130**	**>130**
	96	91	95	98	104	108	120	128	**>130**	**>130**
	94	89	93	95	100	105	111	122	128	**>130**
	92	87	90	92	96	100	106	115	122	128
	90	85	88	90	92	96	100	106	114	122
	88	82	86	87	89	93	95	100	106	115
	86	80	84	85	87	90	92	96	100	109
	84	78	81	83	85	86	89	91	95	99
	82	77	79	80	81	84	86	89	91	95
	80	75	77	78	79	81	83	85	86	89
	78	72	75	77	78	79	80	81	83	85
	76	70	72	75	76	77	77	77	78	79
	74	68	70	73	74	75	75	75	76	77

Example: The temperature stands at 94°F and the RH is now 62%. The heat stress temperature is over 111°F, in the **Danger** area

IV. CONTROL METHODS

ACCLIMATIZATION. The human body can adapt to heat exposure to some extent. This physiological adaptation is called acclimatization. After a period of acclimatization, the same activity will produce fewer cardiovascular demands. The worker will sweat more efficiently (causing better evaporative cooling), and thus will more easily be able to maintain normal body temperatures.

NIOSH (1986) recommends that for workers who have previous experience in jobs with heat stress, the regimen should be 50% exposure on day one, 60% on day two, 80% on day three, and 100% on day four. For new workers who will be similarly exposed, the regimen should be 20% on day one, with a 20% increase in exposure each additional day.

FLUID REPLACEMENT. Cool (50°-60°F) water or any cool liquid (except alcoholic and caffeinated beverages) should be made available to workers to encourage them to drink small amounts frequently, e.g., one cup every 20 minutes. Ample supplies of liquids should be available and placed close to the work area.

ENGINEERING CONTROLS

Radiant Barriers block direct sunlight to produce shade or block direct or reflected heat coming from hot surfaces. Surfaces that exceed 35°C (95°F) are sources of infrared radiation that can add to the worker's heat load.

Air Conditioned Recovery Areas provide locales with cooler temperatures to facilitate heat balance recovery during work break periods. These can be adjacent air conditioned structures, trailers, or vehicles (if the vehicle can be safely operated to maintain cool cab temperature).

Increasing Air Flow can reduce heat stress as long as the air temperature is less than the worker's skin temperature. Changes in air speed can help workers stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air) and the rate of evaporation. Because this method does not actually cool the air, any increases in air speed must impact the worker directly to be effective.

If the ambient temperature is higher than 95°F and relative humidity is high, the hot air passing over the skin can actually make the worker hotter. Increases in air speed have no effect on the body temperature of workers wearing vapor-barrier clothing.

AUXILIARY BODY COOLING

Commercially available **ice vests**, though heavy, may accommodate as many as 72 ice packets, which are usually filled with water. The cooling offered by ice packets lasts only 2 to 4 hours at moderate to heavy heat loads, and frequent replacement is necessary. However, ice vests do not encumber the worker and thus permit maximum mobility. Cooling with ice is also relatively inexpensive.

Wetted clothing is another simple and inexpensive personal cooling technique. This approach to auxiliary cooling is effective under conditions of high temperature and low humidity, where evaporation from the wetted garment is not restricted.

WORK PRACTICES

Workgroup Self-Monitoring involves members of the work group visually observing each other for signs of heat stress and reacting to the visual clues to control heat stress.

Work / Rest Break Protocol involves adjusting the duration of work relative to the duration of recovery or rest periods to control heat stress. The Work / Break Protocol is implemented using heart rate, heart recovery rate, and/or body temperature monitoring.

Shift Work Protocol involves varying the time of work to avoid heat stress. This includes working in early morning, cool part of the day, or night work.

WORKER MONITORING

Every worker who works in the Extreme Caution Danger Category is to be personally monitored. These conditions include wearing semi-permeable or impermeable clothing (such as Tyvek PPE or rain suits) when the temperature exceeds 21°C (69.8°F) or when working at extreme physical loads.

Personal monitoring can be done by checking the heart rate, recovery heart rate, body temperature, or extent of body water loss.

Heart Rate Monitoring. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.

Heart Recovery Rate Monitoring. The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (P_1) with the pulse rate taken at 2.5 minutes (P_3) after the rest break starts. The two pulse rates can be interpreted using Table 1.

TABLE 1 HEART RATE RECOVERY CRITERIA

Heart rate recovery pattern	P_3	Difference between P_1 and P_3
Satisfactory recovery	<90	--
High recovery (Conditions may require further study)	90	10
No recovery (May indicate too much stress)	90	<10

Body temperature can be checked with a dedicated digital oral or electronic ear thermometer after work but before the employee drinks water. If the temperature obtained exceeds 37.6°C (99.6°F), shorten the next work cycle by one third.

Body water loss is recommended for assessing cumulative dehydration effects of heat stress. Performing body water loss measurements under short-term (1-2 days) heat stress conditions is optional. Body water loss can be measured by weighing the worker on a scale at the beginning

and end of each work day. The worker's weight loss should not exceed 1.5% of total body weight in a work day. If a weight loss exceeding this amount is observed, increase fluid intake.

V. HEAT STRESS PROGRAM

The following is a recommended basic strategy for management of employee heat stress based on the Heat Stress Index (HIS):

DANGER CATEGORY	CUMULATIVE STRATEGY
NONE	Workgroup Visual Self-Monitoring
CAUTION	Fluid Replacement Protocol Radiant Barriers (provide shade)
EXTREME CAUTION	Heart Rate Monitoring Heart Rate Recovery Monitoring Work /Break Protocol
DANGER	Body Temperature Monitoring Worker Self-Pace Provide Air-Conditioned Recovery Area Shift Work Protocol Body Water Loss Monitoring
EXTREME DANGER	Work permitted only with a written heat stress mitigation plan.

GENERAL SAFE OPERATING PRACTICES

INCLEMENT WEATHER CONDITIONS WSM100.14

Hazard Review

Slips and Falls
Falling Objects
Slick Road Conditions
Downed Trees
Downed or Low Hanging Power Lines
Exposure to Temperature Extremes
Low Hanging Tree Limbs
Freezing Rain
Flooding Conditions and Flooded Roadways
Other Vehicles and Pedestrians

1. When possible, reschedule all non-essential work activities to non-inclement weather times.
2. Always wear appropriate footwear for slippery conditions and try to avoid icy areas whenever possible.
3. Always use caution or avoid walking under trees, power lines and any type of overhead structure that has ice buildup.
4. Never cross or go near downed power lines even if you believe the power is off to the lines.
5. Avoid walking or driving under or near low hanging power lines.
6. All power lines shall be treated as it they are live (energized).
7. Always wear appropriate clothing to ensure warmth, preferably in multiple layers.
8. Avoid driving on excessively snowy and icy roads, if at all possible.
9. If driving is necessary, reduce speed to help retain control of the vehicle.
10. Four wheel drive vehicles should be used if they are available.
11. Always keep emergency safety supplies in your vehicle such as blankets, flares, sand or litter for traction, and some form of communication device in case you become stranded.
12. Always use caution when entering intersections to ensure other approaching vehicles are able to stop.
13. Always pay close attention to the location of pedestrians to avoid hitting them if they should fall in front of you or should your vehicle slide into them.
14. When driving or walking, avoid crossing roads and roadways with standing or moving water from sudden rainfall or flooding. Even small amounts of flowing water can move a large vehicle sideways or sweep a person off their feet. The depth of water or current may be much greater than anticipated; do not drive through standing or flowing water.
15. If lightning is suspected or observed, all activities must be stop and equipment must be evaluated for its potential to attract lightning. Personnel should wait indoors or in vehicles for the storm or lightning to end. If lightning strikes on or near the Site, personnel are to seek immediate shelter in the nearest accessible permanent building or vehicle available. If shelter is unavailable, the response should be to disband from one another and lay low to the ground by dropping to your knees and bending forward with your hands wrapped around your knees, away from any poles or trees.
16. If a tornado warning is issued, seek shelter immediately. A provisional tornado shelter should be identified before the start of work. If sturdy permanent buildings are accessible, go there immediately, moving toward interior hallways or small rooms on the lowest floor.
17. If a tornado warning is issued and you are in a vehicle, go to the nearest building. If there are no buildings nearby, go to the nearest ditch, ravine, or culvert, with your hands shielding your head.

18. If a tornado is sighted or a warning issued while you are in open country, lie flat in a ditch or depression. Hold onto something on the ground, such as a bush or wooden fence post, if possible. Once a tornado has passed the site, site personnel are to assemble at the guard building to determine if anyone is missing or injured. Administer first aid and seek medical attention as needed.

GENERAL SAFE OPERATING PRACTICES

VENOMOUS SNAKES, INSECTS AND POISONOUS PLANTS WSM100.18

Like most incidents and injuries, prevention is important in controlling the hazards from interaction with venomous snakes, insects and poisonous plants. Therefore, each employee shall review the work activities planned to determine what exposure might exist for these particular hazards. Efforts should then be made to minimize situations which might result in a snakebite, insect sting or contact with poisonous plants. To help minimize attraction of snakes and insects, employees should NOT wear bright clothes, perfumes, after shaves, etc. When scheduling work in a known infested area, a First Aid kit should be readily available and medical contingencies should be made for snake bite treatment and treatment of employees sensitive to insect stings.

1.0 VENOMOUS SNAKES

There are four groups of venomous snakes in the United States. Pictures and approximate ranges are provided on **Attachment 1**. To protect against snakebites, the following guidelines should be followed:

1. Employees shall wear work boots, long pants and long sleeved shirts when going into wooded areas and habitats conducive to snakes.
2. In areas known to be the habitat of venomous snakes, snake chaps, legging or other appropriate PPE shall be work.
3. Employees shall be trained in how to identify venomous snakes.
4. Employees working in vegetative areas should be equipped with a bush axe or other brush cutter to clear underbrush and for protection.
5. Employees should avoid reaching or stepping into and over hidden and obscured areas.
6. Employees should make as much noise as possible when approaching a potential snake area. This alerts the snake to your presence and offers the snake time to leave.
7. To reduce your risk of snakebite, avoid touching any snake. Instead, back away slowly. Most snakes avoid people if possible and bite only when threatened, surprised, or handled.
8. If a snakebite occurs, the employee should:
    a. Remain calm.
    b. Immobilize the bitten arm or leg, and stay as quiet as possible to keep the venom from spreading through your body.
    c. Remove jewelry before you start to swell.
    d. Position yourself, if possible, so that the bite is at or below the level of your heart.
    e. Cleanse the wound, but don't flush it with water, and cover it with a clean, dry dressing.
    f. Apply a splint to reduce movement of the affected area, but keep it loose enough so as not to restrict blood flow.
    g. **Don't** use a tourniquet or apply ice.
    h. **Don't** cut the wound or attempt to remove the venom.
    i. **Don't** drink caffeine or alcohol.
    j. **Don't** try to capture the snake, but try to remember its color and shape so you can describe it, which will help in treatment.
    k. Call 911 or seek immediate medical attention, especially if the area changes color, begins to swell or is painful.

    Reference (Item 8): Mayo Clinic.

2.0 INSECT STINGS AND BITES

Stinging or biting insects can be hazardous to outdoor workers. Stinging or biting insects include bees, wasps, hornets, biting flies (deer, black, stable and horse flies), mosquitoes, and fire ants. The health effects of stinging or biting insects range from mild discomfort or pain to a lethal reaction for those workers allergic to the insect's venom. Anaphylactic shock is the body's severe allergic reaction to a bite or sting and requires immediate emergency care.

Bees, wasps, and hornets are most abundant in the warmer months. Nests and hives may be found in trees, under roof eaves, in the ground, or on equipment such as ladders.

Many biting flies including no-see'ums, black flies, horse flies, deer flies, and mosquitoes breed in water or in mucky areas near ponds and swamps. Certain mosquitoes are carriers of vector-borne diseases such as West Nile virus. Biting flies are most active in still-air areas. Many biting flies are active at certain times during the day and particular months during the year. Horse flies, deer flies, black flies, and stable flies are usually most active during the day. Mosquitoes and No-see'ums are usually most active around sunrise and sunset. Deer flies and black flies are most prevalent in early to late spring. Mosquitoes and No-see'ums are most abundant during summer months, but may bite at any time during the year.

Workers should take the following steps to prevent insect stings and bites:

1. Be aware of known allergic reactions that you or co-workers may have to insect stings and discuss appropriate medical care should a sting occur.
2. Allergic employees should carry doctor prescribed emergency epinephrine auto injector (EpiPen, Twinject, etc.) with them during field activities. Stings to an allergic employee who does not have an epinephrine auto injector available requires immediate medical attention.
3. Wear light-colored, smooth-finished clothing.
4. Avoid perfumed soaps, shampoos, and deodorants.
    a. Don't wear cologne or perfume.
    b. Avoid bananas and banana-scented toiletries.
5. Wear clean clothing and bathe daily. (Sweat may anger bees.)
6. Wear clothing to cover as much of the body as possible.
7. Avoid flowering plants when possible.
8. Apply commercially available insect repellant approved for the insect type. If necessary, application of a repellent labeled for biting fly protection may be appropriate. It is always important to apply products according to label directions and to reapply only as needed. Most repellents do not work as well for biting flies as they do for mosquitoes, and therefore must be reapplied more often. **Re-apply after 4 hours.**
9. Keep work areas clean. Social wasps thrive in places where humans discard food.
10. Remain calm and still if a single stinging insect is flying around. (Swatting at an insect may cause it to sting.)
11. If you are attacked by several stinging insects at once, run to get away from them. (Bees release a chemical when they sting, which may attract other bees.)
    a. Go indoors.
    b. A shaded area is better than an open area to get away from the insects.

c. If you are able to physically move out of the area, do not to attempt to jump into water. Some insects (particularly Africanized Honey Bees) are known to hover above the water, continuing to sting once you surface for air.

12. If a bee comes inside your vehicle, stop the car slowly, and open all the windows.
13. Workers with a history of severe allergic reactions to insect bites or stings should consider carrying an epinephrine auto injector (EpiPen) and should wear a medical identification bracelet or necklace stating their allergy.

2.1 First Aid

If a worker is stung by a bee, wasp, or hornet:

1. Have someone stay with the worker to be sure that they do not have an allergic reaction.
2. Wash the site with soap and water.
3. Remove the stinger using gauze wiped over the area or by scraping a fingernail over the area.
4. Never squeeze the stinger or use tweezers.
5. Apply ice to reduce swelling.
6. Do not scratch the sting as this may increase swelling, itching, and risk of infection.

2.2 Identification of Common Stinging Insects

3.0 TICKS

Ticks are important because of the possibility of transmission of Rocky Mountain Spotted Fever, Lyme Disease, other viral or bacterial pathogens, and antigens. Ticks can attach to any part of the human body but are often found in hard-to-see areas such as the groin, armpits, and scalp. In most cases, the tick must be attached for 36-48 hours or more before the disease bacterium can be transmitted (CDC).

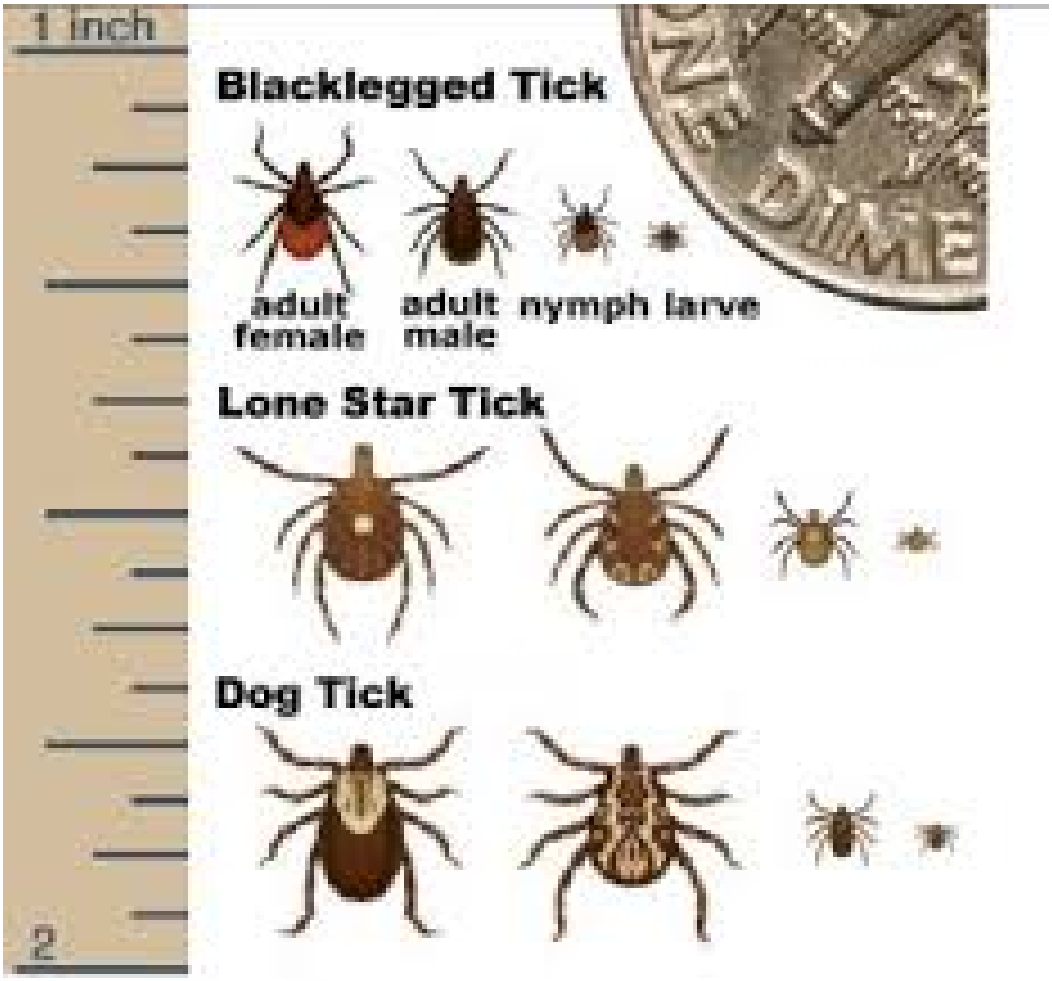
The best way to prevent these potential health issues is to prevent the tick from biting and becoming attached. Pre-bite removal is the best approach. To control exposure, employees should follow these guidelines:

1. Wear appropriate light colored pants and shirts when working in potential tick habitat. Light colors make it easier to spot ticks.
2. Tape trouser legs closed around ankles.
3. Reduce Potential for tick exposure:
    a. Avoid wooded and bushy areas with high grass and leaf litter
    b. Walk in the center of trails.
4. Use a tick repellent. (Available commercially)
    a. Use repellents that contain 20% or more DEET (N, N-diethyl-m-toluamide) on the exposed skin for protection that lasts up to several hours. Always follow product instructions. Apply this product avoiding the eyes and mouth. Repellents can be obtained in stores locally.
    b. Use products that contain permethrin on clothing. Treat clothing and gear, such as boots, pants, and socks. Permethrin remains protective through several washings. Pre-treated clothing is available and remains protective for up to 70 washings. Treated clothing can be obtained at outdoor stores or through outdoor catalog stores.
    c. Other repellents registered by the Environmental Protection Agency (EPA) may be found at http://cfpub.epa.gov/oppref/insect/.
5. Find and Remove Ticks from Your Body
    a. Do a quick check in the field at least twice a day, paying particular attention to the hair and neck area.
    b. Bathe or shower as soon as possible after coming indoors (preferably within two hours) to wash off and more easily find ticks.
    c. Conduct a full-body tick check using a hand-held or full-length mirror to view all parts of your body upon return from tick-infested areas. Check for ticks under the arms, in and around the ears, inside the belly button, behind the knees, between the legs, around the waist, and especially in the hair.
    d. Examine gear. Ticks can ride into the home on clothing then attach to a person later, so carefully examine coats, and daypacks. Tumble clothes in a dryer on high heat for an hour to kill remaining ticks.
6. Use a tick removal tool to remove attached ticks. If no tool is available, utilize tweezers to grab the tick by the head and use gentle uniform tension to remove the tick. Ensure that you remove the tick's embedded head from the skin. Do not use petroleum-based liquids, heat, or squeeze the abdomen of the tick during removal.
7. Attached tick removal is First Aid and requires that an Incident Report be filed in accordance with WSM100.25.
8. Notify your supervisor if a tick is found and request that the date and condition (i.e., attached, crawling) be noted on the field log for future reference. (If possible, retain engorged tick and place it in a container for identification of the tick type by a CEC preferred provider.)

9. Call the CEC preferred provider if fever, chills, headaches or muscle aches develop within 3-10 days after exposure. In some cases, a rash may develop on the wrists and ankles 1-3 days after the fever begins.

3.1 Tick Identification Aid

Three of the ticks most commonly encountered in the U.S. are the American Dog (wood) tick, the deer (blacklegged) tick, and the Lone Star tick. The picture below provides some information on the coloration and relative size of these ticks.\



4.0 POISONOUS PLANTS

Most CEC field employees have the potential to be exposed to at least three types of poisonous plants: poison ivy, poison oak and poison sumac. Reactions range from mild (very little or none) to severe (rash and blisters). Employees who have no reaction may not have become sensitized, but once they are, future exposures can result in an allergic reaction of increasing severity.

Exposure to poison ivy, poison oak, and poison sumac, can be miserable. Even with treatment, you can expect several days or weeks, of itching. And since most people are sensitive to, and have a reaction when exposed to poison ivy and these other plants, avoiding them is important. But to avoid them, you have to learn what they look like.

To avoid these plants, in addition to the basic 'leaves of three, let it be', you should look for these characteristics of poison ivy, poison oak, and poison sumac:

4.1 Poison Ivy Identification

1. Frequently found around lakes and streams in the Midwestern and the Eastern parts of the United States and is also commonly found growing along trails and roadsides
2. Poison ivy grows as a woody, ropelike vine that can grow along fences or up trees, a trailing shrub on the ground, or a free-standing shrub
3. It normally has three leaflets (groups of leaves all on the same small stem coming off the larger main stem), but may vary from groups of three to nine
4. Leaves are green in the summer and red in the fall
5. yellow or green flowers and white berries

4.2 Poison Ivy Pictures

These pictures of poison ivy will help make it even easier for you to identify and avoid these plants:

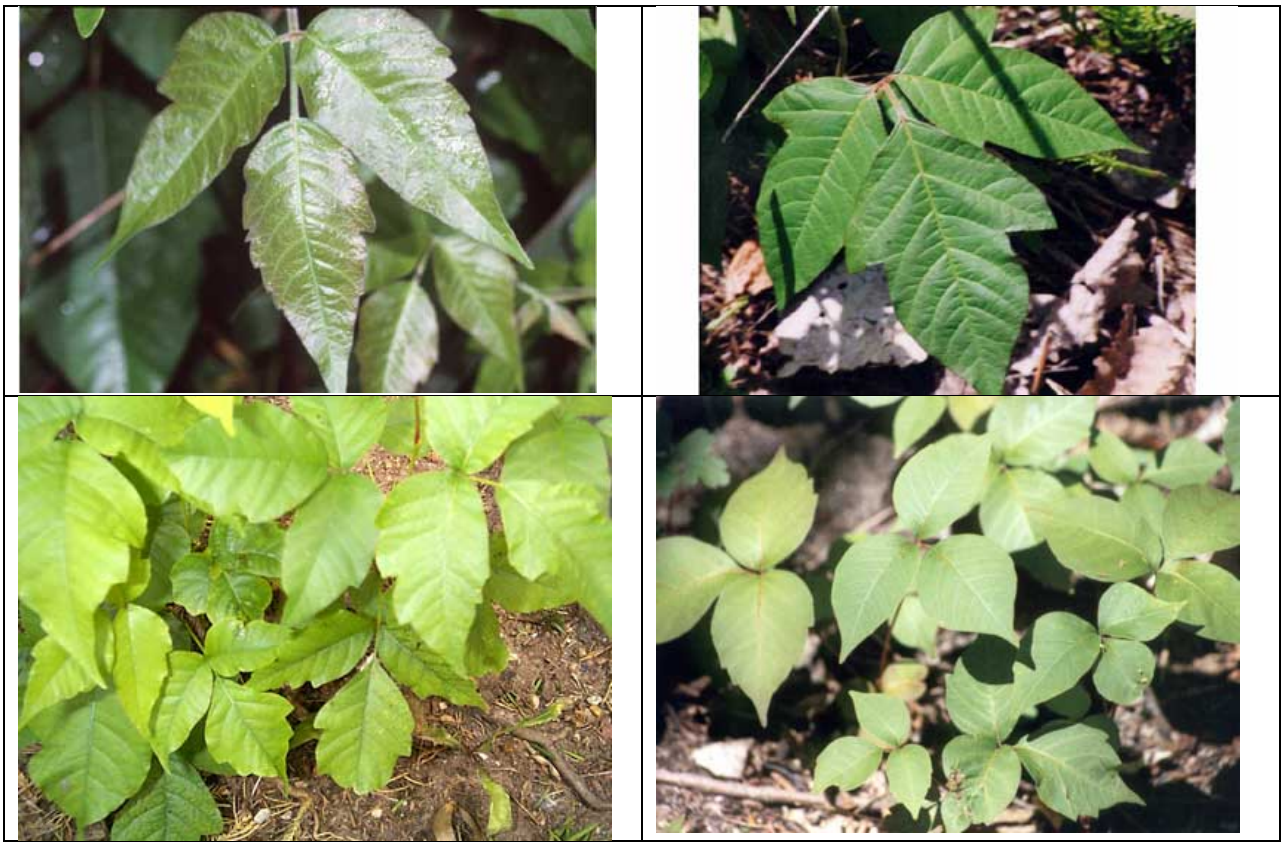


Photo Credits (in order of appearance):

- Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA SCS. 1991. Southern wetland flora: Field office guide to plant species. South National Technical Center, Fort Worth, TX.
- Jennifer Anderson @ USDA-NRCS PLANTS Database
- Copyright: Steve Katz Usage: Royalty Free from istockphoto.com
- Copyright: Audrey Roorda Usage: Royalty Free from istockphoto.com

4.3 Preventing a rash from poison ivy, oak, or sumac

You can prevent a rash by staying away from the plants. If this is not possible, be sure to follow these tips:

1. **Use a skin care product that helps prevent the skin from absorbing the oil (urushiol) that causes the rash.** These products usually contain bentoquatam. You can buy these products without a prescription. Be sure to apply this before going outdoors. **Those with known sensitivity to poisonous plants must apply a pre-contact spray to all body parts susceptible to exposure. This material is available for CEC's safety equipment provider, as well as from other online providers. Re-apply at least every four (4) hours.**

2. **Wear long pants, long sleeves, boots, and gloves when around these plants**. Even when you apply a product that contains bentoquatam, you should protect your skin with clothing.

If you do touch one of these plants, you may prevent a rash by:

1. **Washing your skin well.** Use lukewarm water and soap as soon as you think you've touched a plant.
2. **Washing all clothing and everything else that may have the oil on it.** Urushiol (you-ROO-shee-all) can cause a rash even when it is not on the plant. It remains active for a long time.

4.4 Guidance on Treating Poison Ivy (from the American Academy of Dermatology)

Many people get a rash from poison ivy, poison oak, and poison sumac. This rash is caused by oil found in the plants. This oil is called urushiol. The itchy, blistering rash often does not start until 12 to 72 hours after you come into contact with the oil. The rash is not contagious and does not spread. It might seem to spread, but this is a delayed reaction. Most rashes can be left alone and will go away in a few weeks.

For a mild rash, you can often ease your discomfort by doing one or more of the following:

1. Apply hydrocortisone cream or calamine lotion to the rash.
2. Take antihistamine pills.
3. Place cool cloths on your skin or take a cool shower..
4. Take a lukewarm bath and add oatmeal or baking soda to the water to help calm your skin.
5. Try not to scratch. Scratching can cause an infection. Because the rash can be very itchy, dermatologists recommend keeping your skin and fingernails clean. This can help prevent an infection.

For a serious reaction, you should seek medical treatment. Use the following to decide whether your reaction is serious:

1. You have trouble breathing or swallowing, immediately go to an emergency room.
2. Nothing seems to help ease the itch and you have trouble sleeping due to the itch.
3. You have rashes on several areas of your body or the rash covers a large part of your body.
4. The skin around the rash seems infected. Signs of an infection are pus, pain, swelling, and warmth.
5. You have a fever (another sign of an infection).
6. The rash appears on your eyelids, lips, face, or genitals.

Your face swells, especially if an eyelid swells shut.

4.5 Rash Outcome

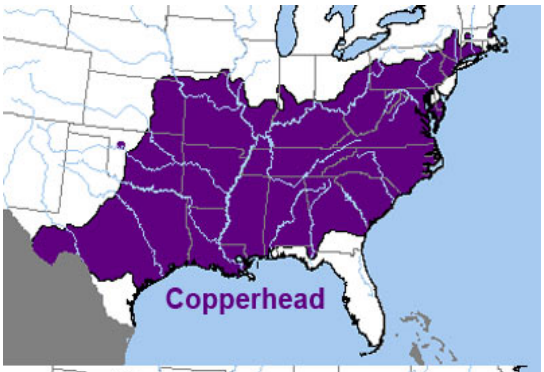
A rash from poison ivy, oak, or sumac usually lasts 1 to 3 weeks. Most go away without treatment.

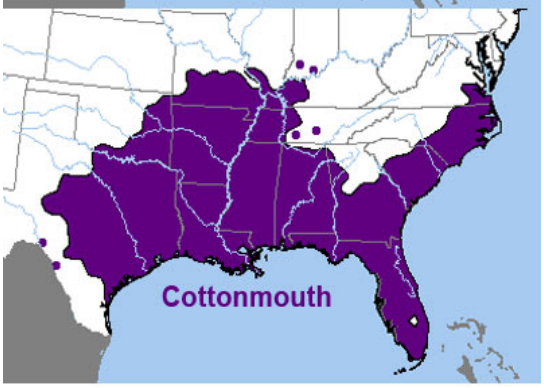
Everyone who gets a rash from one of these poisonous plants should:

1. **Wash the clothing and shoes you wore when you touched the plant**. To remove the oil, you should wash these in hot sudsy water. If the oil is not washed off, the oil can stay active for a long time.

2. **Wash everything else that might have touched the plants**. Did any garden tools, sports equipment, or other objects touch the plant? If so, wash the objects with rubbing alcohol or a mix of water and bleach.

Attachment 1





Types everywhere in the U.S.

GENERAL SAFE OPERATING PRACTICES

SUN EXPOSURE

WSM100.19

Information for both on and off the job.

1. Sunburn can occur during any time of the year. To avoid sunburn, wear hats with wide brims, long sleeve shirts, and use sunscreen with a Sun Protective Factor (SPF) rating of 15 or higher on exposure skin. Premature aging of the skin also occurs with prolonged sun exposure.
2. Excessive sun exposure can result in sunburn. Sunburn can be aggravated by additional sun exposure. When sunburned, avoid additional sun exposure if possible or take additional sun protective measures.
3. By far, the most common cause of skin cancer is overexposure to the sun. Ninety percent of all skin cancers occur on parts of the body that are not usually covered by clothing.
4. People who sunburn easily and those with fair skin and red or blond hair are more prone to develop skin cancer. The amount of time spent in the sun also affects a person's risk of skin cancer.
5. To prevent skin cancer:
   a. Cover up with a wide brimmed hat and a bandanna for your neck. Wear long-sleeved shirts and pants which the sun cannot penetrate.
   b. Use sunscreens to help prevent skin cancer as well as premature aging of your skin. Use a Sun Protective Factor (SPF) rating of 15 or higher. Women may receive added protection by using tinted opaque cosmetic foundation along with a sunscreen. Apply sunscreen at least an hour before going into the sun and again after swimming or perspiring a lot. Do not use indoor sun lamps, tanning salons/parlors, or tanning pills.
   c. You can still get burned on a cloudy day. Try to stay out of the direct sun at midday, because sun rays are their strongest between 10 a.m. and 3 p.m. Beware of high altitudes - where there is less atmosphere to filter out the ultraviolet rays. Skiers should remember that snow reflects the sun's rays, too.
6. Know your skin. Whatever your skin type, do a monthly self-examination of your skin to note any moles, blemishes or birthmarks. Check them once a month and if you notice any changes in size, shape or color, or if a sore does not heal, see your physician without delay.

1.0 OVERVIEW

Driving is among the most hazardous tasks performed by employees; therefore it is imperative to follow safe driving practices. Employees driving on company business are expected to be properly licensed, maintain a favorable driving record, not operate vehicles while impaired in any way, obey applicable traffic laws and follow the established safe operating practices. Safe operating practices for driving include driver training, journey management plans, and pre-trip vehicle inspections.

2.0 SCOPE

While driving on company business, CEC expects its employees to comply with local traffic regulations, while also being conscious of general safe driving practice. The following actions are viewed as serious breaches of conduct:

- Being under the influence of drugs or alcohol while driving
- Driving while disqualified or not correctly licensed or insured
- Driving without proper care and control of the vehicle
- Not being courteous to others while driving
- Driving without regard for state and local traffic regulations
- Driving while distracted
- Failing to stop after an accident

Violations of this policy will be subject to disciplinary procedures, up to and including dismissal.

3.0 RESPONSIBILITIES

3.1 Employees

1. An employee who drives as part of his/her CEC business will:
    a. Hold a current driving license valid for the class of vehicle being operated.
    b. Immediately notify his/her office leader if the license is suspended, cancelled or has limitations placed upon it, or if he/she has personal limitations (e.g. difficulty driving at night or driving on icy roads, driving standard transmission vehicles, the use of medications that cause drowsiness, etc.).
    c. Complete the required driver safety training and prescribed pre-qualifications requirements established as part of this safe operating procedures. First time drivers of a CEC vehicle or drivers who infrequently drive a CEC vehicle must complete a pre-operation driver checkout by your office qualified person.
    d. For Commercial Motor Vehicles (CMV's), use Attachment A – Vehicle Pre/Post-Use Checklist to perform and document a pre-use vehicle inspection prior to leaving the office, which includes taking time to become familiar with the vehicle (including its safety features), as well as a Post-Use inspection when the vehicle is returned to the office.
    e. Conduct a journey management plan for each Long-Haul Trip (a Long-Haul Trip is a trip exceeding 250 miles and/or 4.5 hours driving one way from the starting point) clearly outlining planned route, arrival times, duration of trip, etc. Use Attachment B – Journey Management Plan Form. This form is to be reviewed by the employee's supervisor or Project Manager. This can be done as part of the safety plan for the project.

f. Place the CEC Circle for Safety on the drivers' side door, or on the windshield under the wiper, each time the vehicle is parked.
g. Walk around the vehicle prior to moving from parked location, checking the tires, windows and body of the vehicle. Report any discrepancies.
   i. Check the area surrounding the vehicle to determine if there are obstructions or anything else that could possibly be a safety hazard to the vehicle.
   ii. Once the Circle of Safety is completed, remove the magnet from the side of the vehicle prior to getting in.
h. Report vehicle defects (rental cars) to the rental company before the start of the trip.
i. Always wear a seat belt in vehicles so equipped, and ensure all passengers wear seat belts. Ensure the number of passengers never exceeds the number of available seat belts.
j. Transport passengers only in the vehicle cab.
k. Be directly responsible for the safe operation of the vehicle, while observing all relevant regulations (e.g. obeying posted speed limits). This includes verification that loads are secured and within the vehicle manufacturer's specification and legal limits for the vehicle.
l. Where a personal vehicle is used for work, company policy regarding insurance coverage and operating use are observed.
m. Assess driving hazards and anticipate "what if scenarios". Be alert and attentive.
n. Always secure the vehicle when not behind the wheel (e.g. put vehicle in 'park' or 'in gear' and turn off engine when not required to be running, use emergency brake and/or chock wheels, roll up windows, lock doors, etc.).
o. Verify that blank Vehicle Incident Reports are available in the vehicle's glove box.
p. Immediately report any incident (including those that do not result in damage or injury) to the office leader and your project manager or supervisor. Complete the Vehicle Incident Report within 24 hours.
q. Report motor vehicle accidents as required to the local police. Include a copy of any police report and information about other drivers/vehicle involved as part of the Vehicle Incident Report.
r. If driving a CEC vehicle or vehicle/trailer combination with a GVWR of greater than 10,000 pounds, (identified by DOT number on the door of the vehicle), employees must follow the DOT Guidelines for Operating a Commercial Motor Vehicle (Attachment C). Coordinate with Office Leader, Corporate Human Resources, and Corporate Safety Director to ensure that requirements for DOT qualification are met before driving this type of vehicle.

4.2 **Office Leaders**

1. Office Leaders will:
   a. Assign an individual to coordinate the new driver vehicle operation checkout, and to assure that vehicles are properly serviced and maintained.
   b. Prohibit untrained drivers from operating CEC vehicles.
   c. Receive Vehicle Incident Reports and assure that employees involved in vehicle incidents have received needed medical attention, properly reported vehicle incident and have completed the AIR.
   d. Know the DOT criteria for drivers who will operate a CEC vehicle, or vehicle trailer combination with a GVWR or greater than 10,000 pounds, and verify that any employee assigned to operate such a vehicle or vehicle/trailer combination meets the DOT qualifications. See Attachment C for guidance.
   e. Communicate the information about the vehicle incident to Safety Director and Accounting. Accounting will notify CEC insurance carrier concerning the incident.
   f. Conduct incident investigation in coordination with Safety Director.

4.0 HAZARDS

4.1 **Driving hazards include:**

1. Distractions within or around the vehicle
2. Environmental conditions (e.g. weather, landscape topography, vegetation, etc.)
3. Road (or route) conditions
4. Alcohol and/or drug consumption
5. Other drivers in the area
6. Pedestrians, wildlife
7. Vehicle condition
8. Lack of driving skill
9. Size / type of vehicle

5.0 CONTROLS

5.1 **Drowsiness:**

1. Plan ahead and take into consideration pre-trip work duties, the length of the trip and post-trip commitments.
2. When driving long distances, consider traveling the day before, or stay over an extra day.
3. Stay overnight if driving time and non-driving duties exceed 16 hours or 500 miles in one day. If for unavoidable reasons you have to drive over these limits, approval must be obtained from your supervisor.
4. It is the responsibility of each employee to ensure that he/she comes to work rested and alert in order to carry out work duties safely.
5. When driving, take regular and adequate rest breaks.
   a. At least 15 minutes for each 2 hours driven
   b. Stop when tired
   d. Share driving if travelling with other employees
6. At no time should an employee put him/herself in a position where he/she feels unsafe, whether it is on location or driving to a location.
7. If an employee is requested by a Client to drive to its location and he/she believes the road conditions are unsafe, the employee should discuss the matter with his/her supervisor.

5.2 Distractions

1. Driving distractions can assume multiple forms – inappropriate use of electronic devices such as a cellular phone or any other electronic device to make a phone call, text a message, read email messages, manipulate music files or search for information; eating, drinking, putting on makeup, reading a newspaper, operating any other electronic device, or some other type of distracting activity where the driver's mind, eyes, and hands are engaged elsewhere than the road ahead and the steering wheel.
2. All Cell Phone Usage
   a. Employees must adhere to all federal, state or local rules and regulations regarding the use of mobile electronic equipment while driving. Accordingly, employees must not use such equipment if such conduct is prohibited by law, regulation or other ordinance. It is the employee’s responsibility to determine whether such use is restricted or prohibited in a particular area.
   b. While driving for business purposes, employees shall not use hand held cellular communications devices. If permitted by law, regulation, or other ordinance, employees may use hands-free devices. The use of hands-free devices shall not be used under

moderate to heavy traffic conditions or during hazardous weather conditions requiring enhanced driver attention. At all times, it is the employee's responsibility to judge whether permitted cellular phone use would jeopardize safe vehicle operation and act accordingly.

c. Employees are responsible for the distraction created by placing or taking calls while driving. To avoid distraction, incoming calls can be allowed to go to cellular voice mail for a return call later. The employee can also locate a lawfully designated area to pull over and park before making or taking a call.

3. Discipline
   a. Employees who are charged with traffic violations resulting from the use of cellular devices while driving will be solely responsible for all liabilities that result from such actions. Violations of this policy will be subject to disciplinary procedures, up to and including dismissal.

5.3 Environmental and Road Conditions

1. Drivers must adapt when conditions deteriorate due to bad weather or otherwise. Ensure the vehicle is in good condition and be aware of weather and road conditions.
2. The internet is a good tool to assess weather conditions along the route. Tune in to regional radio stations to gain further awareness of accidents and road closures in that area.
3. Check the condition of wipers and volume of washer fluid. For snowy conditions, verify that there is a brush with scraper, a shovel, and where necessary, a blanket and adequate survival gear.
4. Do not exceed posted speed limits.
5. Following distance should be increased in bad weather. Be patient and slow down.
6. If you can't see, don't drive.
7. Remember that puddles can hide dangerous potholes.
8. Use your headlights and beware of other drivers.
9. Be aware that the surrounding landscape can affect your safety. Park your vehicle safely on firm ground, in gear where appropriate, and always use the emergency brake. When on a hill facing down, turn wheels to the curb/ditch; when facing uphill, turn wheels to the center line. Chock your wheels and use traffic cones where necessary. Where possible, position your vehicle such that you have a clear line of sight for oncoming vehicles, and allow space to safely exit and enter the vehicle.
10. If an employee is required to drive a vehicle to a hazardous location (place were fire or explosion hazards may exist due to flammable gases, vapors, combustible or flammable liquids, combustible dust or ignitable fibers or flyings - as described by NFPA, the vehicle MUST be parked outside the hazardous location.

5.4 Alcohol and Drug Use

CEC employees are prohibited from operating a motor vehicle while under the influence of alcohol or drugs.

5.5 Other Drivers, Pedestrians and Wildlife

1. The defensive driver assumes that pedestrians and other drivers may make mistakes and is on guard in the event an error is made.
2. The defensive driver will:
   a. Anticipate that pedestrians or wildlife may do the unexpected.
   b. Scan around the vehicle thoroughly when a pedestrian is present. Pedestrians may walk or stand in a vehicle's blind spots.

c. Adjust driving speed to safely avoid pedestrians or wildlife. It is difficult for pedestrians to correctly judge how fast a vehicle is approaching.
d. Yield the right-of-way to the pedestrian or the wildlife.
e. Be extra careful at night as pedestrians may assume a driver can see them since they can see the vehicle headlights so easily.
f. Be vigilant at all times for presence of wildlife; never assume they will act predictably.

5.6 Vehicle Condition

1. Check vehicle regularly and prior to each Long-Haul Trip (> 250 miles). Checks should include:
   a. Tire inflation
   b. Cleanliness of windows
   c. Mirror adjustment
   d. Function of horn, lights, and brakes (including emergency brake)
   e. Fluid levels, including washer fluid, engine oil, brake fluid, transmission fluid, power steering fluid, fuel, etc.
   f. Condition of windshield wipers and washer fluid
   g. Closure of doors, trunk, and tailgate
   h. General condition and functionality of vehicle
   i. Obstructions
2. Prior to each Long-Haul Trip, complete the Vehicle Pre-Use Checklist (Attachment A).
3. All defects in company vehicles must be noted in the vehicle logbook and made known to the relevant supervisor who in turn will direct the repairs to be completed according to manufacturers' specifications.
4. Secure loads, tools, material or equipment against movement or store in tool or gang boxes. Particular attention must be paid to transporting gasoline.

5.7 Towing

1. Towing of anything shall be prohibited unless the vehicle is specifically designed and equipped for the task.
2. Vehicles designed and equipped for towing shall only tow approved trailers
3. Do not attempt to pull vehicles with any other vehicle than a tow-truck. Chains can snap, and vehicles not designed for towing can be damaged.

5.8 Transportation of Employees

1. Employees and materials or tools must not be transported in the same compartment of a vehicle except where approved seating is provided for the employees and the material or tools are secure against movement.
2. A vehicle driver or passenger must not ride with any part of the body outside the vehicle.
3. Employees must not board or leave any vehicle while it is in motion.
4. Except for cases of dire emergency, seriously injured or ill persons shall be transported for medical treatment by ambulance only.
5. Vehicles that are used for transporting employees must have within the enclosed portion of the vehicle:
   a. Effective ventilation (independent of doors) to provide clean air
   b. Adequate lighting and means of heating and cooling

6.0 TRAINING

6.1 All employees will complete the online Driving Safety Assessment and Driving Policy Quiz.

1. New hires will complete this training within their first week of employment.
2. All employees will complete the Driver Safety Training modules assigned as a result of the Driving Safety Assessment.
3. Field employees (such as Ecological, Survey, Construction Technician, Source Testing Technicians, and Environmental Scientists), individuals "assigned" a vehicle, and others as designated by their Office Leader shall complete refresher training every 2 years.

ATTACHMENT A - VEHICLE PRE/POST-USE CHECKLIST

Employee Name:_____ Office:_____

Date:_____ Time: _____ Vehicle Color:_____

Vehicle Make/Model:_____ Vehicle License Plate Number:_____

Odometer Start:_____ Odometer Stop: _____ Total Mi Driven:_____

CEC Vehicle ❑ Rental ❑ Personal Vehicle ❑

Perimeter Walk-Around	**Item is OK**		**Item is NOT OK**	
Check for signs of vandalism, negligence, damage or unusual conditions				
Check all tires for excessive and unusual wear and proper inflation– include the spare tire if accessible. Make sure rims are in good shape.				
Check under vehicle for signs of leaking fluids				
Check wiper blades (Do they work? Do they need replacement?)				
Check all light systems – brake, head, back-up, running, turn signals, emergency flashers				
Check to make sure doors, truck/toolbox lids, tailgates all open and close properly				
(Make sure you have keys to any toolboxes that you may need to access)				

Check Gauges on Dashboard	**Item is OK**		**Item is NOT OK**	
Fuel level				
Oil light				
Engine Coolant Temperature Gauge				
Service Indicator Lights				
Battery Charge Indicator				

Inside Vehicle	**Item is OK**		**Item is NOT OK**	
Make sure seatbelts are present for all who will be riding in the vehicle				
Make sure horn, steering, and parking brake works				
Secure all cargo in the vehicle so that items will not become projectiles in the event of sudden stops or collisions				
Adjust the seat position, rearview and side mirrors				
Make sure emergency equipment is present and secured				
Adjust temperature controls, vents, radio, etc.				

If Pulling a Trailer	**Item is OK**		**Item is NOT OK**	
Is trailer properly hitched to the vehicle (including safety chains)				
All lights are working properly				
Proper trailer for the load (check weight specifications) and load is balanced. If you anticipate the load is near the trailer weight limit, weigh the trailer at a weigh station				
Are tires in good condition and properly inflated?				

Notify the vehicle manager or Rental Company if you feel that any deficiencies are unsafe and DO NOT drive the vehicle

Signature: _____

ATTACHMENT B - JOURNEY MANAGEMENT PLAN FORM

Required for each Long-Haul Trip (a trip exceeding 250 miles and/or 4.5 hours driving one way from the starting point). Clearly outline the planned route, arrival times, duration of trip, etc. This form should be approved by the employee's supervisor or Project Manager.

<table>
<tr><td colspan="2">Driver Name:</td><td>Trip Date:</td></tr>
<tr><td colspan="2">Journey Management Details</td><td>Number of Passengers</td></tr>
<tr><td colspan="2">Is this Journey Necessary? ❒ Yes ❒ No</td><td></td></tr>
<tr><td colspan="2">Can it be combined with another Journey? ❒ Yes ❒ No</td><td>Names of Passengers</td></tr>
<tr><td colspan="2">If No, why?</td><td></td></tr>
<tr><td colspan="2">Will the driver reach the destination before dark? ❒ Yes ❒ No</td><td></td></tr>
<tr><td colspan="2">Trip Description:</td><td></td></tr>
<tr><td colspan="2">Origin:</td><td></td></tr>
<tr><td>Departure Date:</td><td>Departure Time:</td><td>Vehicle Information</td></tr>
<tr><td colspan="2">Destination:</td><td>Make/Model:</td></tr>
<tr><td>Arrival Date:</td><td>Expected Arrival Time:</td><td>Owner:</td></tr>
<tr><td colspan="2">Route – Briefly describe</td><td>Defensive Driver Training Complete</td></tr>
<tr><td colspan="2"></td><td>❒ Yes ❒ No Date:</td></tr>
<tr><td colspan="2"></td><td>Driver's Cell Number</td></tr>
<tr><td colspan="2">Expected Road Conditions/Other Known Hazards</td><td></td></tr>
<tr><td colspan="2"></td><td>Driver's Emergency Contact Number</td></tr>
<tr><td colspan="2">Driver informed of driving Life Saving Rules: seatbelt use, no speeding, no cell phone use while driving, no alcohol/drugs while on company time</td><td>Phone Number at Destination</td></tr>
<tr><td colspan="2">❒ Yes ❒ No</td><td></td></tr>
<tr><td>Driver's Signature</td><td colspan="2">Approver's Signature</td></tr>
<tr><td></td><td colspan="2"></td></tr>
<tr><td>Date:</td><td colspan="2">Date:</td></tr>
</table>

ATTACHMENT C - DOT COMPLIANCE GUIDANCE

This section pertains to VEHICLES

The following requirements apply to all CEC vehicles and vehicle/trailer combinations where the GVWR exceeds 10,001 lbs. (Commercial Motor Vehicles - CMV). The current list of vehicles that exceed 10,001 lbs. is attached.

- Each CMV vehicle shall have the CEC DOT number (2638111) applied to the front driver and passenger door, centered, approximately 4 inches from the bottom. DOT numbers are to be affixed to those vehicles which have a GVWR rating greater than 10,001 lbs. and those vehicles which will be used to pull a trailer, even if the GVWR is less than 10,001 lbs.
- All vehicle occupants must wear seatbelts
- Radar detectors are not permitted in any CMV.
- CMVs must have a fire extinguisher (rated 5 B:C or more) securely mounted and readily accessible within the vehicle.
- The following information must be maintained and available for each CMV:
  - Identifying information, including company number, make, serial number, year, and tire size
  - A schedule of inspections to be performed, including type and due date
  - Inspection, repair, and maintenance records
  - These records must be retained for one year at the location where the vehicle is garaged and maintained for six months after the vehicle leaves the carrier's control (e.g., sale, trade-in, scrap).
  - 2^{nd}, 3^{rd}, and 4^{th} bullets above are the manufacturer's maintenance schedule. Maintain the manual with the schedule in the glove box to show that: (1) scheduled services are conducted, and (2) we know when upcoming services are required.
- Written pre- and post- trip inspections must be conducted for all CMVs. This report must cover at least the following parts and accessories:
  - Parking (hand) brake
  - Steering mechanism
  - Lighting devices and reflectors
  - Tires
  - Horn
  - Windshield wipers
  - Rearview mirrors
  - Coupling devices
  - Wheels and rims
  - Emergency equipment
  - The report must list any condition that the driver either found or had reported to him/her that would affect safety of operation or cause a breakdown. If no defect or deficiency is reported or found, the report should state this. The driver must sign the report in all cases. All deficiencies must be corrected or identified as not needing immediate correction before sending the vehicle out again. The original inspection reports and the certification of repairs for at least three months from the date of preparation.

Vehicles (except those greater than 10,000 pounds - F-350s and Sierra) marked with DOT numbers and not pulling trailers (so less than 10,001 lbs. in aggregate), are not classified as Commercial Motor Vehicles, and can be operated by any authorized employee.

Current List of CEC Commercial Motor Vehicles (CMVs)

Unit	Office	#	Project #	Year	Make	Model	VIN Number	Plate	Driver/Pool Vehicle	BT	Cam	Sens	GWVR	Source	Comments
MK1D47	Pittsburgh	00	V00-072	2012	Ford	F-250	1FT7X2B60CEA58477	ZBS0559	Cummings-Pittsburgh	No	No	No	10,000	Enterprise	
MK1D71	Pittsburgh	00	V00-073	2012	Ford	F-250	1FT7X2B68CEA66178	ZBS0564	Dalton - Pittsburgh	No	No	No	10,000	Enterprise	
MK0E40	Pittsburgh	00	V00-085	2012	Ford	F-250	1FT7X2B69CEC11034	ZCK8780	West, Tim	No	No	No	10,000	Enterprise	
MKD137	Pittsburgh	00	V00-137	2015	Ford	F-250	1FT7X2B69FEA47370	ZGC4169	Pool - Pittsburgh	Yes	No	No	10,000	Dealer	Dual-Fuel CNG
MKD138	Pittsburgh	00	V00-138	2015	Ford	F-250	1FT7X2B60FEA47371	ZGC4168	Pool - Pittsburgh	Yes	No	No	10,000	Dealer	Dual-Fuel CNG
MKD139	Pittsburgh	00	V00-139	2015	Ford	F-250	1FT7W2B66FEA47359	ZGC4170	Pool - Pittsburgh	Yes	No	No	10,000	Dealer	Dual-Fuel CNG
MKD147	Pittsburgh	00	V00-147	2015	Ford	F-250	1FT7X2B67FEA89181	ZGG2810	Pool - Pittsburgh	Yes	No	No	10,000	Dealer	Dual-Fuel CNG
MKD156	Pittsburgh	00	V00-156	2015	Ford	F-250	1FT7X2B69FEC41137			Yes	No	No	10,000	Dealer	Dual-Fuel CNG
MKD158	Pittsburgh	00	V00-158	2015	Ford	F-250	1FT7X2B60FEC41141			Yes	No	No	10,000	Dealer	Dual-Fuel CNG
MKD163	Pittsburgh	00	V00-163	2015	Ford	F-350	1FT8W3B67FEB86264		Pool - Pittsburgh	Yes	No	No	10,800	Dealer	
MK1D73	Sayre	18	V00-074	2012	Ford	F-250	1FT7X2B6XCEA66179	ZBS0565	Pool - Sayre	No	No	No	10,000	Enterprise	
MK3E10	Sayre	18	V00-094	2012	Ford	F-250	1FT7X2B67CEC30505	ZCH3477	Pool - Sayre	No	No	No	10,000	Enterprise	
MK3E11	Sayre	18	V00-095	2012	Ford	F-250	1FT7X2B65CEC30504	ZCH3478	Pool - Sayre	No	No	No	10,000	Enterprise	
MKD154	Sayre	18	V00-154	2015	Ford	F-250	1FT7X2B62FEC41139	7GT4010		Yes	No	No	10,000	Dealer	Dual-Fuel CNG
MKD155	Sayre	18	V00-155	2015	Ford	F-250	1FT7X2B69FEC41140			Yes	No	No	10,000	Dealer	Dual-Fuel CNG
MK8B30	Columbus	03	V00-068	2011	Ford	F-150	1FTFW1EF8BFB59070	PHH9328	Pool - Columbus	No	No	No	7,350	Enterprise	Ordered 2/10/11
MK3081	Columbus	03	V00-084	2012	Ford	F-150	1FTFW1EF5CFA83115	PHR7752	Pool - Columbus	No	No	No	7,350	Dealer	Bought off the lot 4/24/12
MK8E35	Columbus	03	V00-098	2012	Ford	F-150	1FTFW1EF9CFC32366	PHW1937	Pool - Columbus	No	No	No	7,350	Enterprise	
MK8E20	Columbus	03	V00-099	2013	Ford	F-150	1FTFW1EF4DFA80711	PHX5803	Pool - Columbus	No	No	No	7,350	Enterprise	
MK4F42	Columbus	03	V00-106	2013	Ford	F-150	1FTFX1EF2DKE40692	PHZ6454	Pool - Columbus	No	No	No	7,450	Enterprise	Transferred from Cleveland P12 2014
MK4F43	Chicago	06	V00-103	2013	Ford	F-250	1FT7W2BT2DEA86565	343031D	Pool - Chicago	Yes	No	No	10,000	Enterprise	Arrived 3/13/13
MK4F44	Chicago	06	V00-104	2013	Ford	F-250	1FT7W2BT0DEA86564	343032D	Pool - Chicago	Yes	No	No	10,000	Enterprise	Arrived 3/13/13
MKV734	St. Louis	07	V00-059	2003	Ford	F-150	1FTRX18W13NA68140	971MW1	Pool - St. Louis	No	No	No	6,950	Dealer	
MKV736	St. Louis	07	V00-061	2007	GMC	SIERRA	1GTJK33G37F154413	969TY4	Pool - St. Louis	No	No	No	7,000	Dealer	
MK8B05	St. Louis	07	V00-065	2011	Ford	Explorer	1FMHK8D84BGA53995	HG7J1D	Pool - St. Louis	No	No	No	6,160	Enterprise	Arrived 5/30/11
MK5D76	St. Louis	07	V00-076	2012	GMC	SIERRA	1GT423C86CF158469	09A2FU	Pool - St. Louis	No	No	No	13,000	Enterprise	
MK2F10	St. Louis	07	V00-102	2013	Ford	F-350	1FT8W3DT7DEA61832	39A9GL	Pool - St. Louis	Yes	No	No	14,000	Enterprise	
MK4H15	St. Louis	07	V00-144	2014	Ford	Explorer	1FM5K8B89EGC49425		Pool - St. Louis	Yes	No	No	6,160	Enterprise	
MK4H24	St. Louis	07	V00-145	2014	Ford	F-250	1FT7W2B68EEB12260		Pool - St. Louis	Yes	No	No	10,000	Enterprise	
MK5J89	St. Louis	07	V00-153	2014	Ford	F-150	1FTFW1EFXEFA44460		Mark Kohrt	Yes	No	No	6,900	Enterprise	
MK7E38	Charlotte	12	V00-097	2012	Ford	F-350	1FT8W3CT7CEB76768	EB8801	Pool - Charlotte	Yes	No	No	13,300	Enterprise	
MK1F52	Charlotte	12	V00-115	2013	Ford	F-350	1FT8W3CT4DEA86558	ED5103	Pool - Charlotte	Yes	No	No	14,000	Enterprise	
MK4F41	Bridgeport	14	V00-100	2012	Ford	F-250	1FT7X2B63CEB84946	2MA947	Jason Hinter	No	No	No	10,000	Enterprise	
MK9F69	Bridgeport	14	V00-117	2013	Ford	F-150	1FTFX1EF1DFC40699	6WE781	Rob Boyd	No	No	No	7,350	Enterprise	
MK0G11	Bridgeport	14	V00-122	2013	Ford	F-150	1FTFX1EFXDFC14246	6WK527	Pool	No	No	No	7,350	Enterprise	
MKD129	Bridgeport	14	V00-129	2013	Dodge	Ram 2500	3C6TR5H25DG574852	1LT422	Nate Thomas	No	No	No	10,000	Dealer	Dual-Fuel CNG
MK6K81	Knoxville	16	V00-169	2015	Ford	F-350	1FT8W3CT8FEB66738			Yes	No	No	14,000	Enterprise	Diesel, DRW

This section pertains to CEC Employees that Drive CMVs

CEC DOT Drivers, who, for a single trip, drive a CMV more than 150 air miles from their point of origin (see attached maps), must maintain a drivers' hours-of-service log book for just those trips. The log book is not otherwise required. However, these drivers must provide documentation of hours worked for the previous 7 days.

CEC DOT Drivers have the following hours of service limitations:

- After 10 consecutive hours off duty, may drive 11 hours.
- After 10 consecutive hours off duty, aggregate of work and drive time cannot exceed 14 hours
  - Example #1 – Employee may come in and work 3 hours, and then drive 11 hours. If the employee comes in and works 4 hours, they can only drive 10 hours; if they work 5 hours, they can only drive 9 hours; etc.
  - Example #2 – Two employees are driving to a project site. Driver 1 drives no more than 11 hours, and Driver 2 can drive no more than an additional 3 hours. Or, Driver 1 drives 7 hours and Driver 2 drives 7 hours. The combination of driving hours cannot exceed 14 hours.
  - Example #3 – Three employees are driving to a project site. Driver 1 drives 5 hours, Driver 2 drives 5 hours, and Driver 3 can drive no more than 4 hours. The combination of driving hours cannot exceed 14 hours.
- 60/70-Hour Limit: **May not drive after 60/70 hours on duty in 7/8 consecutive days. A driver may restart a 7/8 consecutive day period after taking 34 or more consecutive hours off duty.**

Vehicles (except those greater than 10,000 pounds - F-350s and Sierra) marked with DOT numbers and not pulling trailers (so less than 10,001 lbs. in aggregate), are not classified as Commercial Motor Vehicles, and can be operated by any authorized employee.

This section applies to Driver Records that are maintained by and programs that are coordinated by HR

Each DOT driver must have a Drivers' Qualification File containing the information listed below. HR is responsible for developing and maintaining these files and the information in them.

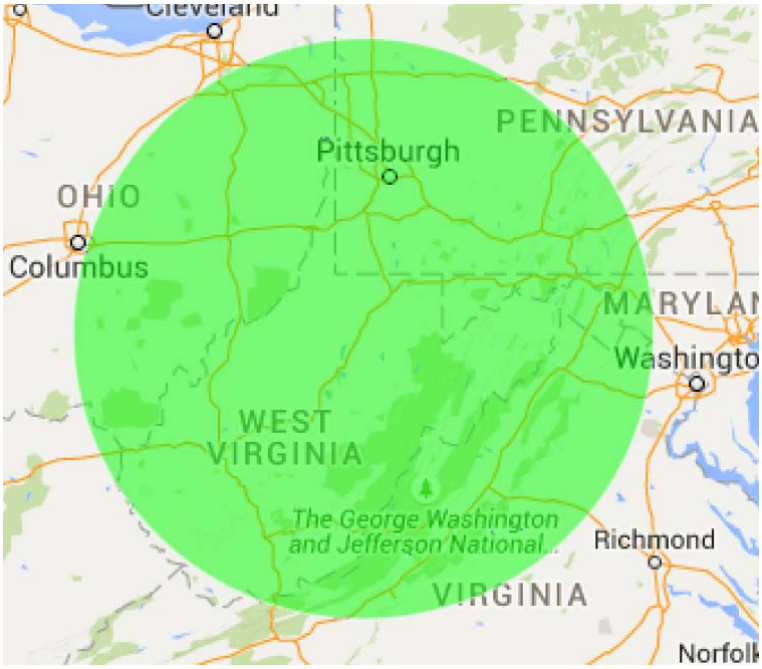
- Driver's Application for Employment
- Drivers Record from state agency cover previous 3 years
- Driver's Road Test Certificate
- Annual Inquiry to State Agencies for Driving Record
- Annual Review of Driving Record
    - Documentation that drivers meet the minimum requirements for safe driving and have no disqualifying offenses:
        - Loss of driving privileges
        - DUI
        - Transportation of controlled substances
        - Leaving the scene of an accident
        - Felony involving the use of a motor vehicle
- Annual Driver's Certification of Violations
    - Drivers must furnish a list of all violations of motor vehicle traffic laws during the previous 12 months
- Medical Examiner's Certificate
- Inquiry to Employee's Previous Employers (3 years)

Each DOT driver must have a DOT physical, and also be included in a DOT Drug/Alcohol Testing Program, which include:

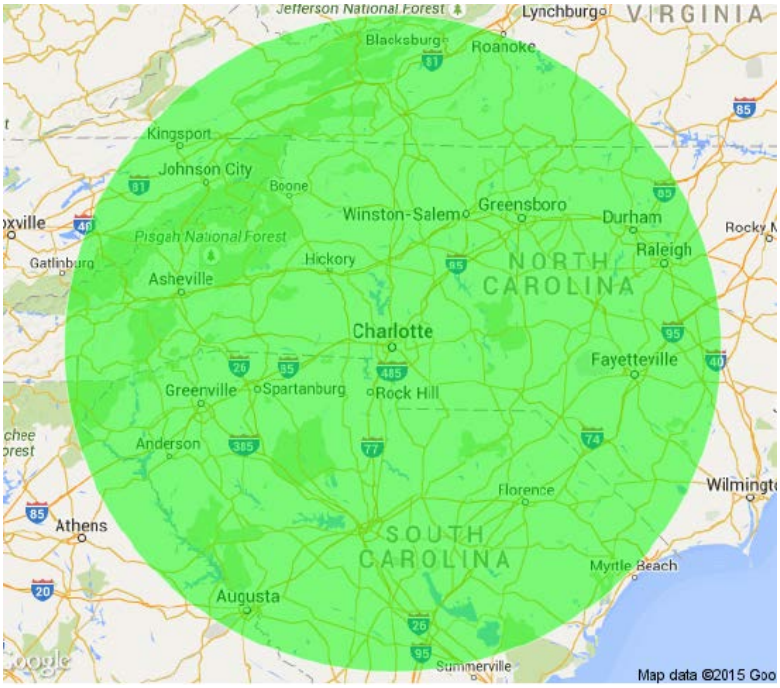
- Pre-employment Testing
- Post-accident Testing
- Random testing
    - 10% of annual drivers for alcohol
    - 50% of annual drivers for controlled substances
- Reasonable Suspicion

150 AIR MILES FROM OFFICE OF ORIGIN MAPS

BRIDGEPORT



CHARLOTTE



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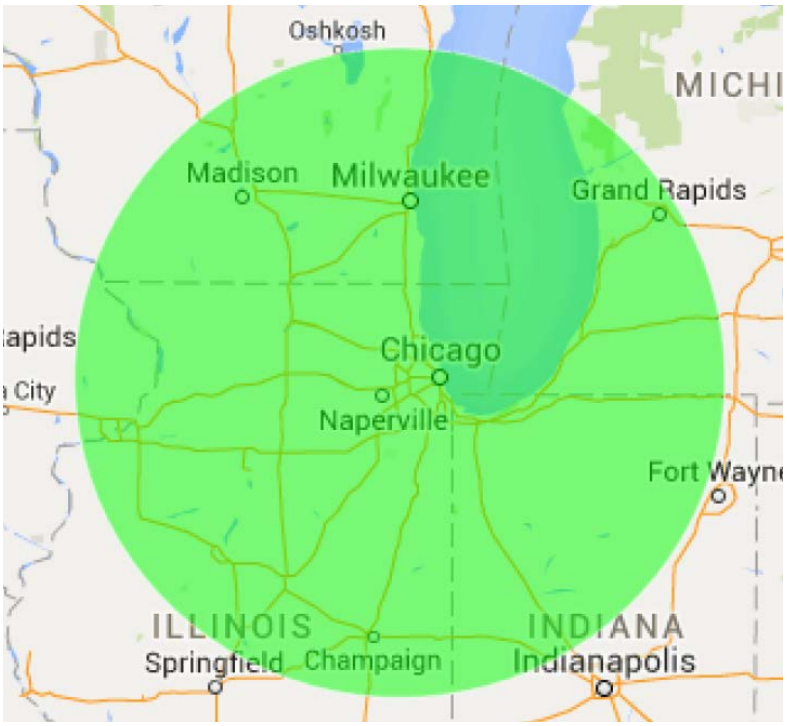

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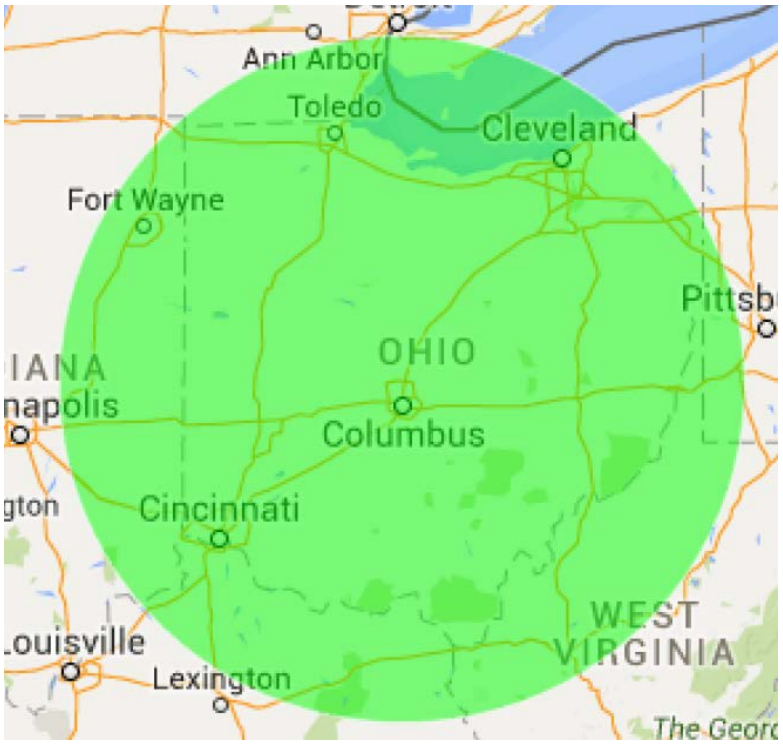

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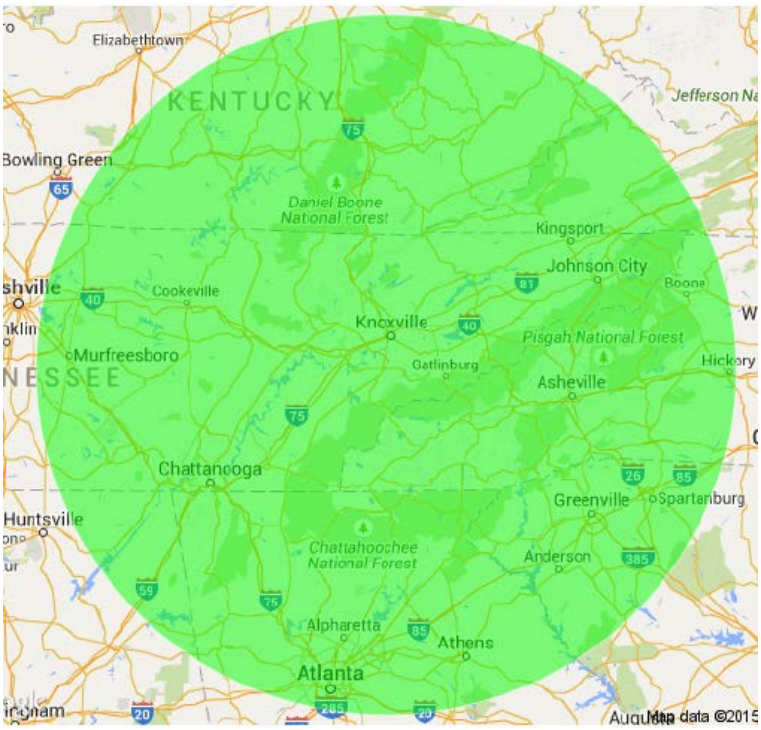
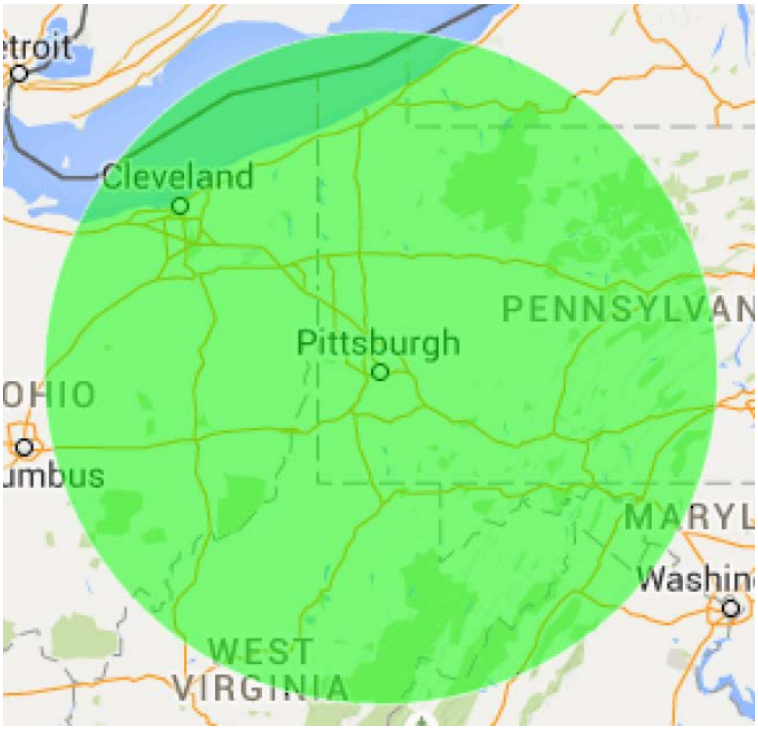
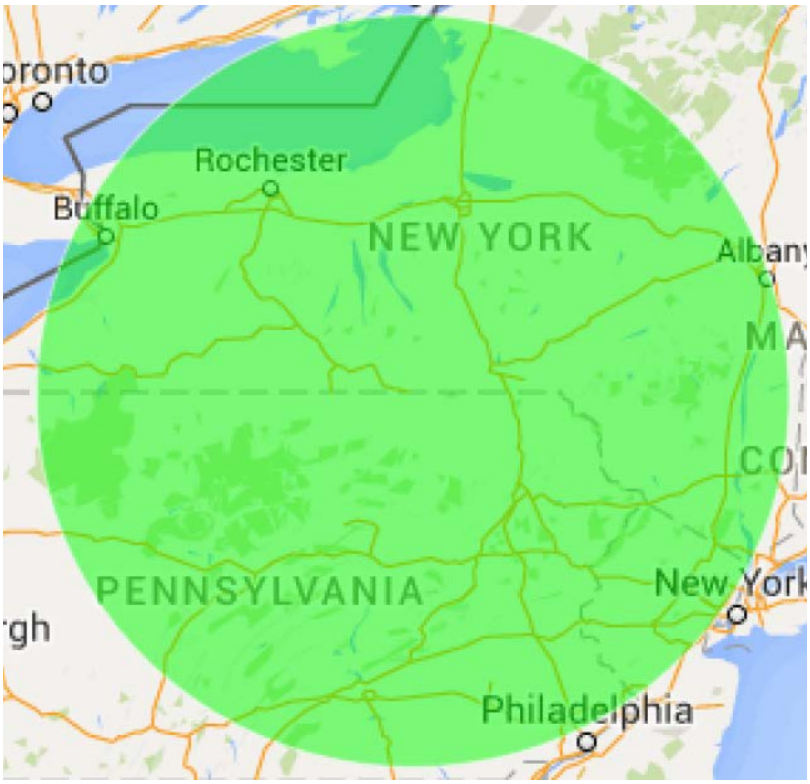


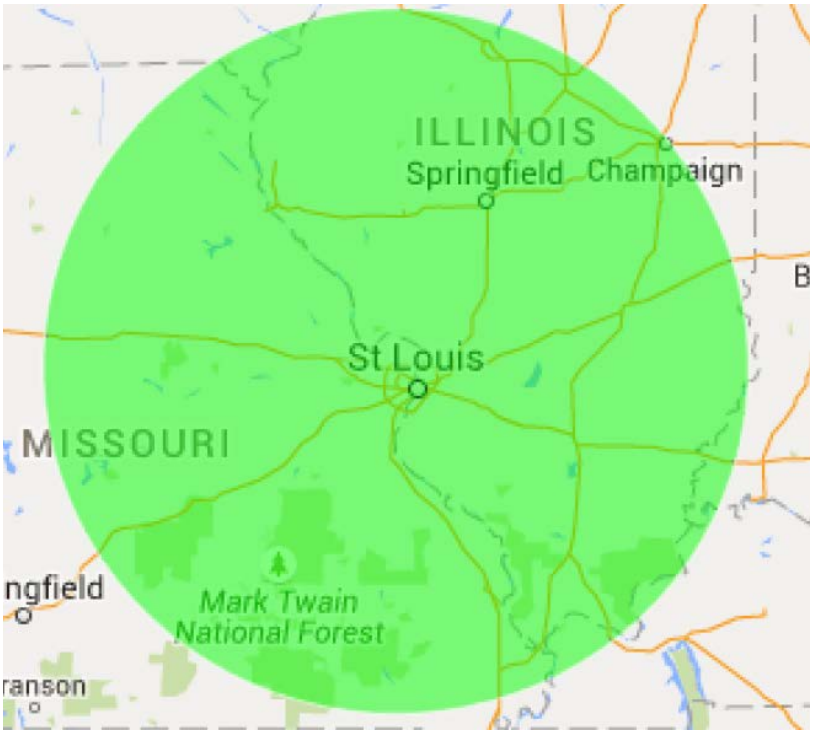
PITTSBURGH



SAYRE



ST. LOUIS



GENERAL SAFE OPERATING PRACTICES

WET WEATHER SAFETY

WSM100.21

Building issues:

1. Employees should be aware and alert to wet floor hazards in their area and report them to the individual responsible for notifying building maintenance.
2. Housekeeping and custodial crews shall inspect entrances and remove water accumulation throughout the work day.
3. Door mats should be periodically examined for saturation.
4. Umbrella and wet apparel should be stored in enclosed containers and away from door and entrance ways.
5. Accessible handrails should be used to aid in preventing slipping accidents.
6. Report and document in writing leaks found around doors, windows and other locations to the building maintenance staff and building owner.

Driving issues:

7. Adjust travel times and travel speed to road conditions.
8. Ensure adequate visibility by keeping windshield wipers at optimum capacity.
9. Use headlights on overcast and rainy days. If wipers are in use, turn on daytime running lights or headlights.
10. Do not take street vehicles off road during wet weather conditions. Use off road vehicles where available.
11. Listen for updated weather conditions and take appropriate precautions to ensure safe arrival at your destination.
12. Ensure tires are in good condition.

GENERAL SAFE OPERATING PRACTICES

USE OF MOBILE ELECTRONICS WHILE DRIVING WSM100.22

Hazard Review

Bodily Injury
Inattention to Road Conditions
Single Vehicle Accidents
Property Damage
Mental Distraction
Multiple Vehicle Accidents

The use of mobile electronic devices of any type including, but not limited to, cell phones, Blackberry, Smartphones, iPads, iPods, or GPS units while driving may distract the driver from the safe operation of the vehicle resulting in a hazard to the driver, passengers, and the general public. The prime responsibility of the driver is the safe operation of the vehicle. The objective of this safe operating practice is to aid in the safe operation of company, rental, or private vehicles while an employee is on work time and conducting activities within the scope of business. This SOP does not prohibit passengers from the use of mobile electronic devices as long as such use does not distract the driver.

All Cell Phone Usage

Employees must adhere to all federal, state or local rules and regulations regarding the use of mobile electronic equipment while driving. Accordingly, employees must not use such equipment if such conduct is prohibited by law, regulation or other ordinance. It is the employee's responsibility to determine whether such use is restricted or prohibited in a particular area.

While driving for business purposes, employees shall not use hand held cellular communications devices. If permitted by law, regulation, or other ordinance, employees may use hands-free devices.
The use of hands-free devices shall not be used under moderate to heavy traffic conditions or during hazardous weather conditions requiring enhanced driver attention. At all times, it is the employee's responsibility to judge whether permitted cellular phone use would jeopardize safe vehicle operation and act accordingly.

Employees are responsible for the distraction created by placing or taking calls while driving. To avoid distraction, incoming calls can be allowed to go to cellular voice mail for a return call later. The employee can also locate a lawfully designated area to pull over and park before making or taking a call.

Discipline

Employees who are charged with traffic violations resulting from the use of cellular devices while driving will be solely responsible for all liabilities that result from such actions. Violations of this policy will be subject to disciplinary procedures, up to and including dismissal.

GENERAL SAFE OPERATING PRACTICES

BENZENE AWARENESS WSM100.29

Benzene is a chemical that CEC employees may encounter during the performance of consulting activities. It is important to be aware of the locations where benzene may be encountered; its physical and chemical properties, potential health effects, and symptoms of exposure;, and the requirements for personal protection equipment use , safety precautions, and emergency plans associated with this chemical.

Additional Names

Benzene is synonymous with benzol, benzole, coal naphtha, cyclohexatriene, phene, phenyl hydride, and pyrobenzol. (Benzin, petroleum benzin and Benzine do not contain Benzene).

Potential Locations

Benzene is a component of gasoline and a solvent in many manufacturing processes. Benzene is present at petroleum refining, storage, and transfer (pipeline and tanker loading) locations, and is used in field maintenance of equipment.

Physical and Chemical Properties

Benzene is a clear, colorless liquid with a distinctive sweet odor. Its boiling point is 176 degrees F and its flash point is 12 degrees F. It is not soluble in water. The flammable limits in air are 1.3% Lower Explosive Limit (LEL) and 7.5% Upper Explosive Limit (UEL).

Benzene is a flammable liquid. Its vapors can form explosive mixtures. Where liquid or vapor may be released, such areas shall be considered as hazardous locations.

Benzene vapors are heavier than air; thus the vapors may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which Benzene is handled.

Benzene is classified as a 1 B flammable liquid according to 29 CFR 1910.106. A Benzene concentration exceeding 3,250 ppm is considered a potential fire explosion hazard. Locations where Benzene may be present in quantities sufficient to produce explosive or ignitable mixtures are considered Class I Group D for the purposes of conforming to the requirements of 29 CFR 1910.309.

Health Effects

Benzene is a human health hazard through the inhalation of vapors or mists and through direct contact with the skin. Short-term effects of overexposure may include: irritation of eyes, nose and skin, breathlessness, irritability, euphoria, headache, dizziness, or nausea. Long-term effects may result in blood disorders such as leukemia and anemia.

Personal Protection Equipment

Dependent on the concentration and potential for exposure, boots, gloves, sleeves, aprons, eye and face protection and respiratory protection may be required to protect against the effects of benzene exposure.

Safety Precautions

1. Smoking is prohibited in areas where benzene is used or stored. All ignition sources must be controlled.
2. Benzene liquid is highly flammable and vapors may form explosive mixtures in air. Fire extinguishers must be readily available in areas where benzene is used or stored

Emergency Precautions

Employees performing work where benzene is stored or used must obtain instruction from the host facility in the specific contingency plans and provisions in use. Employees must be informed where benzene is used in the host facility and aware of additional plant safety rules.

1.0 PURPOSE

The Working Alone Standard Operating Procedure (SOP) is intended to mitigate risks to employees when they are working alone. Project managers shall apply all reasonable measures to protect employees who are performing their duties in areas or under conditions where they are required to be on their own.

2.0 SCOPE

This procedure applies to all CEC employees who are required to work alone. This SOP will be reviewed and revised not less than every three years or sooner if circumstances at a workplace change in a way that poses a risk to the safety or health of a worker working alone or in isolation.

3.0 DEFINITIONS

3.1 Risk Assessment

A thorough examination of an operation for the purpose of identifying what actual and potential hazards exist

3.2 Working Alone

Individuals are considered to be working alone when they are working by themselves without close or direct supervision. Assistance, in the event of an injury, illness, or emergency, is not readily available to the individual.

3.3 Emergency Assistance

A means of communication to gain assistance in the event of an emergency involving an accident or serious injury, illness, or threat of violence.

3.4 After Hours

The period of time when “normal” weekday or shift operations cease.

3.5 Field Work

Field work consists of work activities that are being performed outside an office environment.

4.0 RESPONSIBILITIES

4.1 Employees

1. Participate in the working alone risk assessment and risk management decisions with project managers.
2. Read and understand this SOP.
3. Maintain regular communication as outlined in the Health & Safety Plan (HASP).

4.2 Project Manager

1. Identify risks or hazards associated with the work to be performed or the environment where the work is to be done.
2 Conduct and document a risk/hazard assessment for each different (specific) type of work or work location that can be deemed to be a working alone situation.
3. Utilizing the HASP, communicate the results of the risk assessment to all affected workers and others conducting similar work.
4. Provide written working alone procedures in their area of responsibility in order to eliminate or minimize identified risks.
5. Verify quality of cell coverage for where the work is to be done utilizing provider's service maps, and in remote areas, by directly contacting service providers.
6. Develop effective methods of communication for those who may require emergency assistance, depending on the specific work, location of the work, and nature of the work. (For example: cell phones, radio, and pager). When electronic devices are not feasible, an effective contact system must be established (For example: check-in procedures and periodic site visits requiring employees to check in after the completion of specific tasks). The length of time an employee may be out of contact with a supervisor (the frequency of regular communications) must be based on the result from the risk assessment.
7. Using Attachment A – Working Alone Checklist, document and communicate when working alone is permitted and/or prohibited.
8. Schedule potentially hazardous work for times when supervisors and appropriate help will be available.
9. Provide adequate staffing (for example: buddy system) for hazardous tasks performed at off-hours or remote locations.

5.0 HAZARDS

5.1 High Risk Activities

High risk activities are activities where the potential for the occurrence of accidents or injuries is deemed to be highly likely and where the severity of the injury or accident will bring serious consequences. High risk activities include the following (not all-inclusive):

1. Working from heights
2. Working in confined spaces (employees are not permitted to work alone in a confined space)
3. Lock out/tag out
4. Working with electricity
5. Working with hazardous substances or materials
6. working with material under high pressure
7. working where there is a possible threat of violence
8. working in isolation from first aid services or immediate/emergency assistance

5.2 Low Risk Activities

Low risk activities are activities where the potential for the occurrence of accidents and injuries is deemed to be highly unlikely and where the severity of an accident or injury is generally thought not to have serious consequences.

6.0 CONTROLS

6.1 Working Alone Prohibitions

1. Working alone will be prohibited under the following circumstances:
   a. At no time will an employee be permitted to work in a confined space alone.
   b. Tunnels and manholes are considered confined spaces, and as such, employees are not permitted to enter them alone.
   c. Work shall not be done on an energized electrical conductor or equipment that has a voltage of more than 750 volts unless 2 or more workers are present while the work is being performed.
   d. Use of a vehicle, crane, or similar equipment near a live power line where it is possible for any part or the equipment or its load to make contact with the live power line.
   e. Operating a vehicle, crane, mobile equipment, or similar material handling equipment where the operator does not have full view of the intended path of travel.
   f. If the task requires the use of fall arrest equipment and scaffolds.
   g. When using quick-acting, acutely toxic material as described by the Material Safety Data Sheet.
   h. When using of supplied air respiratory equipment or self-contained breathing apparatus.
   i. Where there exists the risk of drowning.
   j. During welding operations where a fire watcher is required.
   k. While performing tasks which, based on the risk assessment conducted by leadership in consultation with the employee, are deemed to require more than one person.

6.2 Communication

1. Consideration shall be given to the most practical and effective means of communication:
   a. *Portable or cell telephone,*
   b. Walkie-talkie,
   c. Personal alarm or pager,
   d. Buddy system,
   e. Check-in system and requirement for updating an individual's status while working alone, or
   f. Any other method that may be considered most effective.
2. Each working alone scenario will use these communication options, either singularly or in combination in the development of the HASP.
3. When Working Alone requires work in remote areas where cell phone coverage is limited, Project Managers shall, with the approval of the appropriate Principal or Office Leader, provide the employee with a SPOT Satellite device or similar.

6.3 Guidelines for Conducting Working Alone Risk Assessments

1. It is mandatory that the working conditions or circumstances that present high safety risks be assessed so the probability of accident or injury can be minimized. The HASP is the tool that should be used to document this process. Project managers and employees will evaluate working alone assignments on a case-by-case basis and will consider the following risk factors:
   a. Tasks and hazards involved in the work to be performed.
   b. Consequences resulting from a "worst case" scenario. This will be accomplished by asking the question, "What if?"
   c. Likelihood for other persons to be in the area.

d. Possibility that a critical injury or incident could prevent the employee from calling for help or leaving the workplace.
e. Emergency response time.
f. Employee's training and experience.
g. Employee's physical handicaps or any pre-existing medical conditions.
h. Frequency of supervision, if at all.
i. The time or shift when the work is to be completed.
j. Whether the individual is accustomed to working alone.

2. Project managers shall include written working alone safety plans on the HASP. Safety plans shall include:
   a. Identification of the risks or hazards associated with the work to be performed or the environment where the work is to be done;
   b. Procedures to eliminate or minimize the identified risks (e.g., buddy systems);
   c. Methods of communication by which the workers can secure emergency assistance and how emergency assistance will be provided in the event of incidents or accidents.
   d. The length of time an employee may be out of contact with a supervisor (i.e., the frequency of regular communications); and
   e. Confirmation where and when working alone is permitted.
3. Project managers must review the working alone section of the HASP with affected employees with particular emphasis on safe work procedures and the provision of assistance to employees at risk due to infrequent supervision, intermittent communication, or physical isolation.

6.4 Emergency Response

1. In the event that a working alone employee does not respond to check-in, status checks, or check-out, the Project Manager (or the CEC Office Lead) will contact the client and other CEC employees performing work in the area in attempts to locate the employee. During this process, another CEC employee will continue attempts at contacting the working alone employee. Should these efforts be unsuccessful by the next status check-in time, authorities will be contacted, the situation explained, and the last verified location of the employee will be provided to them.

7.0 TRAINING OR QUALIFICATIONS

1. Employees who, due to assigned duties, are required to work alone shall receive on-the-job training in the requirements for this procedure.
2. All employees required to work alone must have valid first aid training.

ATTACHMENT A: WORKING ALONE CHECKLIST

Questions	Y/N	Action Required	Target Date for Action	Person Responsible for Action
Has staff received adequate training to carry out their duties when working alone?				
Has staff been provided with adequate means of communication?				
Is there sufficient cell coverage in the proposed work area to provide confidence of contacting emergency services if necessary?				
Can staff be readily contacted?				
Is staff physically able to undertake their duties?				
Where applicable have staff been provided with suitable protective equipment and/or clothing?				
Have all tools and equipment been regularly maintained and checked before use?				
Is access to first aid facilities readily available?				
Is staff aware of the correct incident reporting procedures? They should also be encouraged to report any hazards.				
Are arrangements in place for staff to `phone in' after out-of-hours visits?				
Has the risk assessment been reviewed in the last year and is it still applicable to the current working arrangements?				

Project Manager's Signature

Date

GENERAL SAFE OPERATING PRACTICES

GAS HAZARD AWARENESS WSM100.36

Employees of Civil & Environmental Consultants, Inc. perform inspection and sampling services for a wide-range of industries. Many of the industrial activities use, produce, or create hazardous gases. This safe operating procedure provides an overview of the hazards presented by gases and the requirements when performing services within hazardous gas areas defined by the facility owner.

1.0 TRAINING

CEC employees whose duties require working in proximity to a known or potential gas hazards environment must receive training in the associated hazards and the safe work practices. Training shall be performed prior to initial assignment and annually thereafter if the employee activities include continued work in gas hazard areas. Training shall include gas characteristics, and the signs, symptoms and health effects of overexposure to the specific gases near or within the work area. Training shall include the use of respiratory protection equipment applicable to the specific gas hazard. Documentation of CEC employees receiving Gas Hazard Awareness training shall be maintained in company files.

2.0 TYPES OF GAS HAZARDS

Table 1 provides a summary of common types of gas hazards associated with industrial activities.

The types of hazards produced by the presence of gasses in the work atmosphere include oxygen-deficient, oxygen-enriched, flammable, and toxic. The hazards presented by a gas may occur in combination, e.g. flammable and toxic. Table 2 provides a summary of the hazards associated with commonly encountered gasses. Employees should also refer to CEC General Safe Operating Practices addressing Benzene Awareness (WSM100.29) and Hydrogen Sulfide (WSM100.30) for hazards associated with these chemicals.

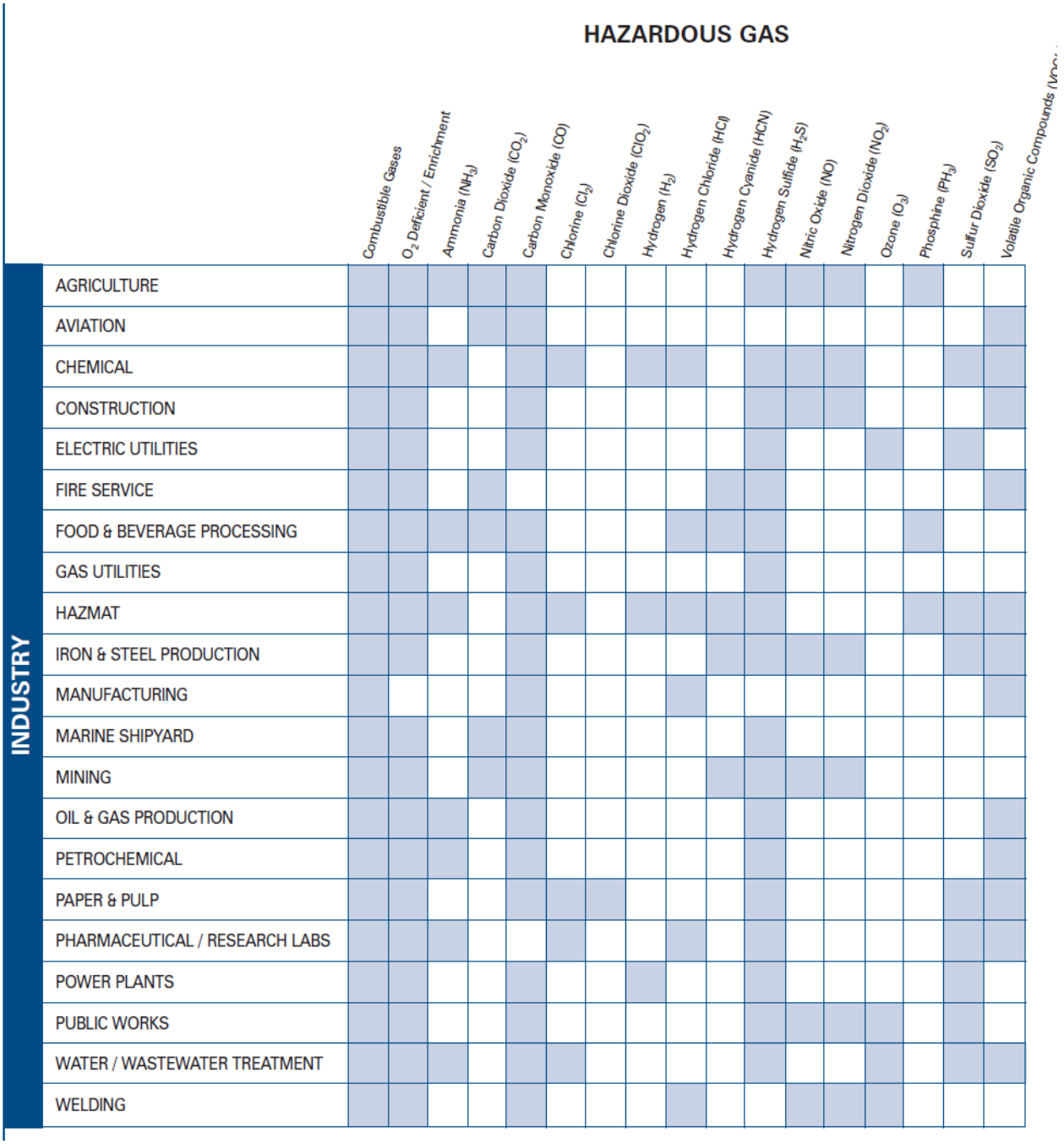
Oxygen-deficient atmospheres (less than 19.5 % oxygen) can occur when oxygen is actively displaced by inerting gases, such as carbon dioxide, nitrogen, or argon. Oxygen-deficient atmospheres can result in asphyxiation. Other heavier than air gasses (e.g., carbon monoxide, hydrogen sulfide) can also displace oxygen resulting in an oxygen-deficient atmosphere. Oxygen-deficient atmospheres result from use of a facilities inert gas firefighting system. Oxygen-deficient atmospheres are the leading cause of confined space fatalities. Oxygen can also be consumed by rusting metal, ripening fruits, drying paint or coatings, combustion, or bacterial activities in enclosed confined spaces.

Oxygen-enriched atmospheres (greater than 22 % oxygen) can occur through certain oxygen-producing chemical reactions, but are typically caused by leaking oxygen hoses and torches. Oxygen enriched atmospheres present a significant fire and explosion risk.

Flammable atmospheres may be produced by the release of gasses or chemical vapors at concentrations above the Lower Explosive Limit (LEL) for the chemical. Under these conditions, an ignition source may produce a flash fire or an explosion depending on the volume of flammable gas present and the degree of gas containment.

Toxic atmospheres may be produced by the presence of corrosive inorganic gasses or fumes or volatile organic chemicals. Toxic atmosphere exposure without appropriate respiratory protection may produce acute (immediate) or chronic (long-term) health effects.

TABLE 1



Source: Industrial Scientific Corporation

TABLE 2

PRIMARY GAS HAZARDS

Gas	***Primary Hazards***				
	Asphyxiant	Toxic	Flammable	Corrosive	Oxidant
Ammonia		X	X	X	
Argon	X				
Butane	X		X		
Carbon Dioxide	X				
Carbon Monoxide	X				
Chlorine		X			
Ethane	X		X		
Ethylene	X		X		
Ethylene Oxide		X	X		
Fluorine		X		X	X
Helium	X				
Hydrogen	X		X		
Hydrogen Chloride		X		X	
Hydrogen Fluoride		X		X	
Hydrogen Sulfide		X	X	X	
Methane			X		
Neon	X				
Nitrogen	X				
Nitric Oxide		X		X	X
Nitrogen Dioxide		X		X	X
Oxygen					X
Propane	X		X		
Sulfur Dioxide		X		X	
Sulfur Hexa-fluoride	X				

3.0 GAS HAZARD MITIGATION

The mitigation of potential gas hazards involves gas detection and monitoring, respiratory protection equipment, and facility gas emergency preparedness.

Gas Detection and Monitoring Equipment: The use of gas detection and monitoring equipment is required when working within a gas hazard area. Gas detection equipment shall be appropriate for monitoring the potential gas hazard and be approved, if required, by the facility owner before use. Employees must be trained in accordance with manufacturer's instructions in the use and limitations of the gas detection equipment. Training shall include the performance of daily field calibration checks and "bump" tests to verify the detection equipment is operating correctly. Gas detection equipment shall contain current calibration stickers showing the date of last calibration.

Respiratory Protection Equipment. Employees working within a gas hazard area must have current medical clearance for respirator use and a current fit test in accordance to CEC's Respiratory Protection Program (WSM400.5 Chapter 8). CEC's Respiratory Protection Program requires initial medical clearance for respirator use prior to fit testing. Medical clearance must be renewed annually. NIOSH certified respiratory protection equipment shall be selected based on the facility gas exposure hazards and facility requirements. Employees shall be trained in the use, maintenance, and limitations of the respiratory protection equipment selected.

Facility Gas Emergency Preparedness: Employees shall be trained by the facility owner in safe work requirements for gas hazard areas. Such training shall include: the location of gas alarm stations, location of fixed gas monitoring stations, facility-specific gas hazards and symptoms of exposure, gas alarm signals, personnel rescue procedures, emergency evacuation procedures, evacuation routes, and the location of primary and secondary staging areas. Any applicable facility-specific procedures for employee check-in and check-out from gas hazard areas shall be reviewed.

FIELD SAFE OPERATING PRACTICES

EARTH MOVING ACTIVITIES

WSM200.17

Including Grading on Sites

Hazard Review

Moving Equipment	Poisonous Plants/Snakes/Insects	Noise
Slip, Trip and Fall	Suspended Loads	Utilities
Moving Traffic	Explosives	Temperature Extremes
Animals		

CEC personnel may be required to observe earth moving and grading activities at client sites. In these cases, CEC personnel should adhere to the following requirements.

1. Determine whether a traffic control plan is in effect at the site and if so, comply with the traffic control plan requirements.

2. Park in areas that provide safe entrance and exit of the work area; do not create potential conflicts with other vehicles and equipment operating in the work area; and provide maximum protection for workers getting in and out of the vehicles.

3. Wear appropriate personal protective equipment consistent with any potential hazard.

4. Employees on foot must use extreme caution to stay clear of operating equipment. Always establish eye contact with operator before approaching equipment. Avoid areas behind moving equipment.

5. Be aware of escape routes in case of emergency. It is a good practice to work facing oncoming traffic while on foot.

6. Take extra precautions to prevent heat and cold stress when working in extremely hot or cold temperatures.

7. Be aware of loose material, excavation drop-off, tripping hazards, uneven ground and other obstructions.

8. Be aware of poisonous plants, insects, snakes, animals, and animal waste products and carcasses. It is a good practice to wear long sleeve shirts, gloves and high-top boots when hazards cannot be avoided.

9. Avoid walking and working under suspended loads. Wear hard hat when working around backhoes, cranes, excavators or where there is a potential for overhead falling objects.

10. Before backing any vehicle that you are operating, make sure area is clear and use an observer when available.

Related SOPs

General SOPs –WSM 100 Series

FIELD SAFE OPERATING PRACTICES

HAND REMOVAL OF VEGETATION

WSM200.19

Hazard Review

Chain Saws	Thorns	Moving Equipment
Sharp Edged Tools	Unwieldy Brush	Utility Lines
Poisonous Plants/Snakes/Insects	Slip, Trip and Fall	Animals
	Overcrowding of Workers	

1. Review Safe Operating Practices for applicable equipment and perform pre-operational checks.

2. Determine whether a traffic control plan is needed and if so, what the requirements for traffic control are. Comply with the traffic control plan requirements.

3. Park in areas that provide safe entrance and exit to the work area. Do not create potential conflicts with other vehicles and equipment operating in the work area and provide maximum protection for workers getting in and out of their vehicles.

4. Wear appropriate personal protective equipment consistent with the hazard. Hearing, face, and eye protection and chaps are required when using chain saws or chippers. The use of worker leg protection is required when operating chain saw.

5. Cut and stack brush in pieces that are easily handled to avoid back injuries.

6. Utilize appropriate mechanical means when moving large quantities of brush.

7. Be aware of poisonous plants, insects, snakes, animals, and animal waste products and carcasses. It is a good practice to wear long sleeve shirts, gloves and high-top boots when hazards cannot be avoided.

8. Allow ample space for each employee to work safely.

9. Stay clear of equipment operating in your work area. Always establish eye contact with the operator before approaching moving equipment.

10. Operators of power hand equipment must be trained and qualified according to WSM300.5 or WSM300.8.

11. Use caution when handling hand tools with sharp edges. Gloves and eye protection are required when sharpening tools.

12. Be aware of loose material, excavation drop-off, tripping hazards, uneven ground and other obstructions.

13. Do not cut limbs that may contact overhead utility lines. Observe and stay clear of overhead utilities.

14. Tree-trimming which would require climbing shall only be performed by a trained specialist or with the assistance of a bucket truck.

15. Use extreme care when cutting trees, brush, etc. that are under stress, e.g., ice conditions.

16. Use appropriate disposal procedures for removed vegetation.

EQUIPMENT SAFE OPERATING PRACTICES

FIELD VEHICLES

WSM300.3

Hazard Review

Death/serious injury Backing
Mounting/Dismounting
Rollover
Pinching/Crushing
Adverse/ Inclement Weather
Traffic conditions
Uneven Terrain

1. All drivers shall be properly licensed.
2. Be familiar with and review the manufacturer's operation manual. Pay special attention to the safety section and operating rules for inclines, slopes, hills, rough terrain and water crossings.
3. Supervisors shall verify that drivers are capable and qualified on each type of equipment before allowing the equipment to be operated unsupervised.
4. Drivers shall perform a vehicle service check prior to use. A visual inspection should be made before each use. Tires and fluid levels should be checked for proper operating levels. Report all needed repairs promptly. Do not use any equipment that is unsafe.
5. All airbags should be in the on position. Seat belts will be worn during operation of the vehicle.
6. Operator will read the vehicle owner's manual and obey all safety warnings before operating any CEC vehicle.
7. Operator will follow the vehicle owner's manual reference on how to operate the vehicle in the four-wheel drive position.
8. Doors shall be in the closed position when the vehicle is being operated.
9. Head restraint should be adjusted so that the top of the restraint is closest to the top of your head.
10. Operator will drive with due regard for the safety of all persons using the road and in a manner cognizant of traffic conditions at the time.
11. When operating off roadways, be aware of uneven terrain, ditches and streams.
12. Do not drive through moving water.
13. If so equipped, avoid use of roll bar lights and overhead lights at night when traveling on public highways
14. If the vehicle experiences equipment failure, the operator will terminate use of the vehicle until it is safe to operate.

Related SOPs
General SOPs – WSM100
Vehicle Operation WSM100.21

EQUIPMENT SAFE OPERATING PRACTICES

HAND TOOLS (POWER AND MANUAL) WSM300.6

Hazard Review

Electrical Shock	Noise	Pinch Points
Dust	Sharp Edges and Points	Improper Tool
Flying Particles	Cuts and Abrasions	

Civil & Environmental Consultants, Inc. (CEC) employees may utilize a variety of hand and/or power tools in the performance of services. The following safe equipment operating procedures are designed to reduce the potential for injury during the use of hand or power tools:

1. Employees shall perform a preoperational check of their equipment. Be familiar with the operator's manual. Tools shall be maintained in a safe condition or be immediately taken out of service by tagging or locking out the controls. Report needed repairs promptly. Do not use any equipment that is unsafe.
2. Wear safety glasses and other appropriate personal protective equipment (such as gloves and hearing protection) consistent with the hazard associated with the tool.
3. Only use tools in the manner for which they are designed to avoid tool damage and personal injury.
4. Visually inspect all tools prior to use and remove damaged tools from service.
5. Ensure that tool handles are free from cracks, splits and splinters prior to use.
6. Ensure that impact tools are free from "mushroomed" heads.
7. Keep work area clean to avoid slipping, tripping or falling.
8. Avoid using dull power tools or hand tools. Power saws, chain saws and drills that have dull blades or bits can cause binding or kickback which can result in cuts, bruises and loss of fingers or limbs to the operator and others.
9. Ensure proper grounding for power tools.
10. Be aware of safety devices on tools; check regularly and use only tools with all safety devices properly operating. Do not use electric power tools with damaged cords or switches.
11. Place tools in safe position when not in use so that sharp points are not exposed. Carry all sharp tools in a sheath or holster.
12. When using knives, shears or other cutting tools, cut in a direction away from your body.
13. Store tools in an appropriate manner, such as storage cabinets and wall storage units.

Related SOPs
General SOPs WSM100

LEAD HEALTH AND SAFETY PROGRAM WSM400.9

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

1.0 INTRODUCTION

Exposure to lead occurs in over 120 different occupations, including primary and secondary lead smelting, lead storage battery manufacturing and recycling, lead pigment manufacturing and use, shipbuilding and ship repair, auto manufacturing, printing, demolition, repainting operations and the remediation and management of lead-containing soil and wastes. Due to the nature of the engineering services provided by Civil & Environmental Consultants, Inc. (CEC), potential exposure to various forms and amounts of lead may occur during certain job activities.

2.0 IDENTIFICATION OF LEAD HAZARD AND EMPLOYEE TRAINING

2.1 The potential for encountering lead during the performance or oversight of work must be evaluated as part of job planning and hazard assessment.

2.1.1 If work involves disturbing paint or surface coatings on metal structures or pre-1978 building materials, coatings must be tested for lead using chip samples or lead paint test kits to evaluate the potential for hazard.

2.1.2 Facility manufacturing or chemical processes must be evaluated based on process knowledge or air monitoring assessments by the host facility to assess potential hazards from lead-containing dusts, mists, or fumes.

2.1.3 Work involving the disturbance of soils or wastes must be evaluated based on existing chemical data available for the materials.

2.2 Should lead hazards be identified as a result of the evaluation, a project-specific compliance program should be prepared that addresses the activities where lead exposure hazards may occur, the air monitoring to be performed and the engineering and work practices that will be used to control exposure.

2.3 All employees potentially exposed to lead hazards must be trained prior to job activity in the requirements of this program and annually afterward if potential exposure continues. The training must include an identification of operations that could result in exposure to lead above the action level, the health hazards of lead, how to protect themselves from lead exposure including respiratory protection, and medical monitoring for assessing lead exposure. The training will also note the worker protections required by 29 CFR 1929.62 including *Appendix A – Substance Data Sheet for Occupational Exposure to Lead* and *Appendix B – Employee Standard Summary*.

3.0 DEFINITIONS

3.1 **Action Level:** Employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 ug/m3 as an 8-hour time weighted average.

3.2 **Medical Program:** Medical examination with blood sampling and analysis performed under the supervision of a licensed physician prior to initial exposure to lead above the action level and repeated periodically over the exposure period. Enrollment on the medical program is at no cost to the employee.

3.3 **Lead Permissible Exposure Limit (PEL)**: Employee exposure limit to an airborne concentration of lead of 50 ug/m3 as an 8-hour time weighted average. No employee should be exposure to lead at concentrations greater than this value.

3.4 **Respiratory Protection Program:** Procedures included at WSM400.5 Section 8 specifying the medical clearance, fit testing, and training requirements for use of respiratory protection equipment.

3.5 **ZPP –zinc protoporphyrin:** ZPP is a compound found in red blood cells when heme production is inhibited by lead and/or by lack of iron.

4.0 ASSESSMENT OF LEAD HAZARDS

4.1 Unless a current site and activity-specific evaluation of lead exposure exists at a facility to define exposure, personal air monitoring must be performed to initially determine the airborne concentration of lead as a 8-hour time weighted average for employees exposed to lead dust or fume. Full shift employees should be used to represent regular daily exposure.

4.2 If initial personal air monitoring activity-specific results are above the action level but below the PEL, personal air monitoring of employees performing the specific activity should be performed every six months. Personal air sampling may be discontinued if two consecutive measurements taken at least 7 days apart are below the action level.

4.3 If initial personal air monitoring activity-specific results are above the PEL, personal air monitoring of employees performing that specifc activity should be performed quarterly.

4.4 Employee personal lead air monitoring results shall be communicated to affected employees within 15 days of receipt of results. Communication can be performed by written notice to each affected employee or by posting written results in an area accessible to affected employees.

4.5 Should employee personal lead air monitoring results exceed the PEL, the written notice will include a statement that the PEL was exceeded and identify the actions to be taken to reduce exposure to or below the PEL.

5.0 LEAD-SPECIFIC MEDICAL PROGRAM

5.1 Any employee anticipated to be exposed to lead above the action level for 30 or more days must be enrolled in the lead-specific medical program prior to exposure to establish a baseline followed by subsequent retesting during exposure.

5.2 Blood lead and ZPP testing will be performed at least every 6 months during exposure. For exposures less than 6-months in duration, both a baseline and post-exposure test shall be performed.

5.3 The lead-specific medical program will be performed under the supervision of a licensed physician knowledgeable in OSHA lead exposure requirements.

5.4 Employee enrollment in the lead-specific medical program will be at no cost to the employee.

5.5 Blood level and ZPP testing result copies shall be provided to affected employees within 5 days of testing results.

5.6 Employees exhibiting blood lead levels at or greater than 50 ug/dl shall be notified in writing within 5 days of test receipt and removed from further exposure to lead. Such employees shall not be permitted additional lead exposure until two consecutive monthly blood lead level tests are below 40 ug/dl. During the employee removal period, the employee shall be provided alternate work or full pay and benefits.

6.0 LEAD ZONE WORK PRACTICES

6.1 Warning signs shall be posted indicating the existence of a lead exposure hazard in any work zone where the PEL is known to be exceeded.

6.2 No eating, drinking, use of tobacco products, or applying cosmetics is permitted within lead work zones.

6.3 A clean area separated from the lead work zone must be established for employees to take breaks and to each lunch.

6.4 Wash-up facilities must be available and used regularly by employees to clean up before breaks, lunch and at the end of the work day.

6.5 Clean protective clothing (disposable or regularly laundered on a weekly basis) shall be provided at no cost to the employee. Protective clothing provided may include gloves, hoods, face shields, goggles, shoes or disposable shoes covers dependent on the specific activity. Disposable protective clothing shall be properly disposed. Non-disposable protective clothing shall be repaired or replaced as needed. Protective clothing must not be worn home or removed from the work area. Changing facilities will be provided for the removal of protective clothing.

6.6 For workers regularly exposed to high levels of lead, shower facilities should be available and used before leaving the job site.

7.0 EXPOSURE CONTROLS

7.1 Where practical, lead-free materials will be substituted for materials containing lead.

7.2 The lead work zone will be kept as free as possible from lead contamination through regular cleaning using safe methods such as wet mopping or HEPA vacuuming. Dry sweeping is not permitted in lead work zones.

7.3 Engineering controls, such as local work zone ventilation, or changing work practices will be used to reduce airborne lead concentrations to below the PEL before relying on respirators or administrative (employee rotation).

8.0 RESPIRATORS

8.1 The use of respirators for the control of lead exposure shall comply with CEC's Respiratory Protection Program (WSM400.5 Section 8). This program includes medical clearance, fit testing, and training in the proper use and care of the respiratory protection equipment issued to the employee and selection of appropriate protective equipment based on exposure levels and the assigned protection factor(APF) of the specific respiratory protection device.

8.2 Respirators shall be used during the work period needed to implement engineering or work practice controls, when engineering or work practice controls are impractical or ineffective in controlling airborne lead levels, and during emergencies.

9.0 RECORDKEEPING

9.1 Employee exposure testing results including initial and periodic monitoring will be maintained in the employees file by CEC's Human Resource Department in compliance with HHPA requirements for the duration of employment plus thirty years.

JOB HAZARD ANALYSIS (JHA) WSM100.23

This guidance provides a formal process for supervisors and employees of Civil & Environmental Consultants, Inc. (CEC) in performing a Job Hazard Analysis (JHA) for any task or activity not covered by an existing WSM Safe Operating Practice (SOP). This process can be applied to routine or non-routine tasks and is especially valuable when tasks involve new processes, changes in processes or operations or the addition of new services. CEC employees working outside the office must be trained in the JHA process. CEC employees and any subcontractors involved should be involved in the process of preparing a JHA.

1.0 JOB HAZARD ANALYSIS PROCESS

The JHA process focuses on a breakdown of the task or activity into its fundamental actions as a way to identify hazards and formulate hazard control strategies. The JHA process is best performed prior to performing the task as a collaborative effort among CEC managers, CEC employees with experience performing related tasks, CEC employees with no experience performing related tasks, and any subcontractors involved. The WSM100.23 Job Hazard Analysis (JHA) template (Attachment A) should be used to document the JHA process and as a means of required communication of the JHA to other employees and subcontractors.

1.1 Task Description

Define the task or activity clearly to include a defined start, end, and a series of fundamental actions comprising the work. The task description should include defining the required physical movements, location of objects involved, the tools used, and the work conditions under which the task will be performed (e.g. inside, outside, hot, cold, limited illumination, other contractors working in the same locale).

1.2 Hazard Identification

Based on the Task Description, identify the potential hazards considering the following basic hazard categories:

1. Impact (falls, falling objects, struck by objects)
2. Penetration
3. Compression (roll-over)
4. Chemical
5. Heat / Cold
6. Harmful dust
7. Light (optical) radiation
8. Geographic (slopes, cliffs, water bodies)
9. Natural (e.g. wildlife, poisonous plants, biohazards)

Consider whether the work environment or the task includes any of the following potential hazards:

1. Sources of motion; i.e., machinery or processes where any movement of tools, machine elements or particles could exist, or movement of personnel that could result in collision with stationary objects;
2. Sources of high temperatures that could result in burns, eye injury or ignition of protective equipment;
3. Types of chemical exposures;
4. Sources of harmful dust;

5. Sources of light radiation, i.e., welding, brazing, cutting, furnaces, heat treating, high intensity lights, etc.;
6. Sources of falling objects or potential for dropping objects;
7. Sources of sharp objects which might pierce the feet or cut the hands
8. Sources of rolling or pinching objects which could crush the feet;
9. Layout of workplace and location of co-workers; and
10. Any electrical hazards.

In addition, review injury/accident data to help identify potential hazards.

3.3 Hazard Evaluation

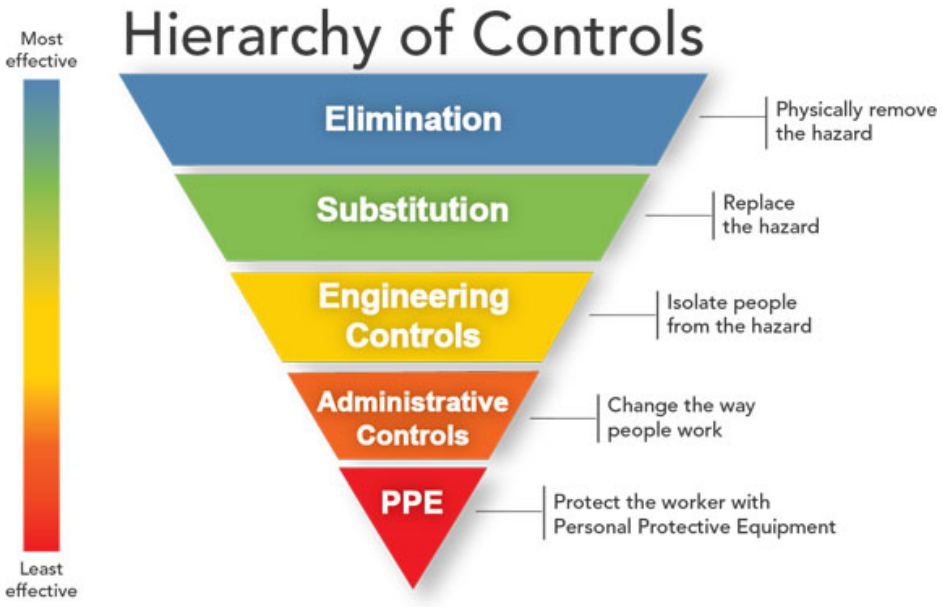
The objective of the hazard evaluation is to prepare an analysis of the hazards in the work environment to enable implementation of hazard control strategies (e.g. work process modification, engineering control, and selection of protective equipment). Review each of the basic hazards identified and perform a ranking with regard to the type, level of risk, and severity of potential injury from each of the hazards identified. Consider the possibility of exposure to several hazards simultaneously. In performing the hazard evaluation work through the task by developing answers to the following:

1. What can go wrong and result in an injury?
2. What are the consequences of the injury?
3. How could this occur?
4. What are the contributing factors?
5. What is the likelihood that the hazard would result in injury?

3.4 Hazard Control Guidelines

It is the policy of CEC that PPE devices alone should not be relied on to provide protection against hazards, but should be used in conjunction with engineering controls and safe work practices to avoid or mitigate hazards.

After completion of the procedures in paragraphs 1, 2, and 3, the Hierarchy of Controls should be referred to in order to select the most effect hazard control:



1. Elimination or Substitution. Avoid putting employees in the hazardous situation by eliminating the hazard, or substituting it for something less hazardous, if possible;
2. Engineering/Administrative Controls. Control the hazard by physically guarding the employee from the hazard; or
3. Personal Protective Equipment (PPE). It is necessary to consider certain general guidelines for assessing the foot, head, eye and face, and hand hazards that exist while performing any operation and to match hazard control strategies to the particular situation. It is the responsibility of each employee to exercise common sense and appropriate expertise to accomplish these tasks.
4. Assess the requirements for specific PPE using the guidance in WSM100.17.
5. Provide personal protective equipment (PPE) appropriate for type of hazard.
    a. Become familiar with the potential hazards and the type of protective equipment that is available, and what it can do; e.g., splash protection, impact protection;
    b. Compare the hazards associated with the environment; i.e., impact velocities, masses, projectile shape, radiation intensities, with the capabilities of the available protective equipment;
    c. Select the protective equipment which ensures a level of protection greater than the minimum required to protect employees from the hazards; and
    d. Fit the user with the protective device and give instructions on care and use of the PPE. Make employee aware of the limitations of PPE.

2.0 MANAGEMENT OF CHANGE

Additional review of job hazard analyses must be performed to evaluate the need for modifications in hazard identification or hazard mitigation under the following conditions:

1. The scope of the task changes or is changed;
2. New personnel become part of the work crew;
3. Site conditions change (e.g. additional contractors working in the area, weather conditions change);
4. A near miss occurs in the performance of work; or
5. An incident or other work stoppage occurs.

ATTACHMENT A: JOB HAZARD ANALYSIS (JHA) FORM

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.			Page 1 of 2
JHA # 1	**Version** 1	**Revision Date** N/A	**Origination Date** 4/19/17

Practice:	Environmental	**Reviewed By:**			**Revised By:**
Job/Task:	164-123.2H2C	**Practice Lead:**	**Operations Lead:**	**Corporate HSO:**	
Applicable Job Title (s):	All employees working on this project	**Date:**	**Date:**	**Date:**	**Title:**

MSDS #	LO/TO #	References (i.e. other JHA's, etc.):
N/A	N/A	N/A

Required Personal Protective Equipment (PPE): *(Specific Job Step Required PPE will be detailed in the applicable job steps)*	**Equipment / Tools Required for Job** *(Complete Tool Inspection Prior to Start of job)*
Level D PPE plus high visibility vest and nitrile gloves	

BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS (Struck by, Caught on, Contact by, Caught between, Struck against, Fall, Contact with, Strain-overexertion, Caught in and Exposure)	REQUIRED SAFE JOB PROCEDURE	ADDITIONAL PPE REQUIRED
Overseeing shallow excavations	Struck by excavator	Stay clear of excavator while it's in operation, maintain communication with operator, maintain line of sight with operator	None

ATTACHMENT A: JOB HAZARD ANALYSIS (JHA) FORM

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.			Page 2 of 2
JHA # 1	**Version** 1	**Revision Date** N/A	**Origination Date** 4/19/17

Revision Log

Revision Date	Version	Revisions

EMPLOYEE SIGN-OFF FORM

My name below indicates I have reviewed this JSHA and am aware of the hazards and mitigation strategies used to prevent injury and illness associated with this task.

Date	Name (printed)	Name (signature)

MID-ATLANTIC ENVIRONMENTAL CONSULTANTS, INC.
HEALTH AND SAFETY PLAN

MID ATLANTIC ENVIRONMENTAL CONSULTANTS, INC.
GIBSONIA, PENNSYLVANIA

HEALTH AND SAFETY PLAN

APRIL 2017

PREPARED FOR:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
4000 TRIANGLE LANE
SUITE 200
EXPORT, PA 15632

PREPARED BY:

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MIDATLANTIC@ZOOMINTERNET.NET – EMAIL

1.0 ORGANIZATIONAL STRUCTURE

(in compliance with 29 CFR 1910.120(b)(2))

This chapter of the Health and Safety Plan describes lines of authority, responsibility, and communication as they pertain to health and safety functions at this site. The purpose of this chapter is to identify the personnel who impact the development and implementation of the site health and safety plan and to describe their roles and responsibilities. This chapter also identifies other contractors and subcontractors involved in work operations and establishes the lines of communication among them for safety and health matters.

The organizational structure of this site's safety and health program is consistent with OSHA requirements in 29 CFR 1910.120(b)(2) and provides the following site-specific information:

- the general supervisor who has the responsibility and authority to direct all hazardous waste operations
- the site safety and health officer who has the responsibility and authority to develop and implement this HASP
- and verify compliance
- other personnel needed for hazardous waste operations and emergency response and their general functions and responsibilities
- the lines of authority, responsibility, and communication for safety and health functions

This section is reviewed and updated as necessary to reflect the current organizational structure at this site.

1.1 Roles and Responsibilities

All personnel and visitors on this site must comply with the requirements of this HASP. The specific responsibilities and authority of management, safety and health, and other personnel on this site are detailed in the following paragraphs. A site organizational chart illustrating the hierarchy of personnel and lines of communication within this company and with additional contractors on site is found in Figure 1-1.

Project Manager (PM)

The Project Manager (PM) for this site is Tim Daniels. The PM has responsibility and authority to direct all work operations. The PM coordinates safety and health functions with the Site Safety and Health Officer (SSHO), has the authority to oversee and monitor the performance of the SSHO, and bears ultimate responsibility for the proper implementation of this HASP. The specific duties of the PM are:

Preparing and coordinating the site work plan; providing site supervisor(s) with work assignments and overseeing their performance; coordinating safety and health efforts with the SSHO; ensuring effective emergency response through coordination with the Emergency Response Coordinator (ERC); serving as primary site liaison with public agencies and officials and site contractors.

The qualified alternate Project Manager (PM) for this site is Joe Pillart.

Site Safety and Health Officer (SSHO)

The Site Safety and Health Officer (SSHO) for this site is Tim Daniels. The SSHO has full responsibility and authority to develop and implement this HASP and to verify compliance. The SSHO reports to the Project Manager. The SSHO is on site or readily accessible to the site during all work operations and has the authority to halt site work if unsafe conditions are detected. The specific responsibilities of the SSHO are:

Managing the safety and health functions on this site; serving as the site's point of contact for safety and health matters; ensuring site monitoring, worker training, and effective selection and use of PPE; assessing site conditions for unsafe acts and conditions and providing corrective action; assisting the preparation and review of this HASP; maintaining effective safety and health records as described in this HASP; coordinating with the Emergency Response Coordinator (ERC), Site Supervisor(s), and others as necessary for safety and health efforts.

Site Workers

Site workers are responsible for complying with this HASP, using the proper PPE, reporting unsafe acts and conditions, and following the work and safety and health instructions of the Project Manager (PM), Site Safety and Health Officer (SSHO), and Site Supervisor.

Security Officer

The Security Officer for this site is Tim Daniels. The Security Officer is responsible for managing and maintaining site security. The specific responsibilities of the Security Officer are:

- conducting routine area patrols;
- controlling facility access and egress;
- assisting with communication during an emergency; securing accident/incident scenes;
- maintaining a log of site access and egress.

1.2 Identification of Other Site Contractors

There are no other contractors or subcontractors on this site.

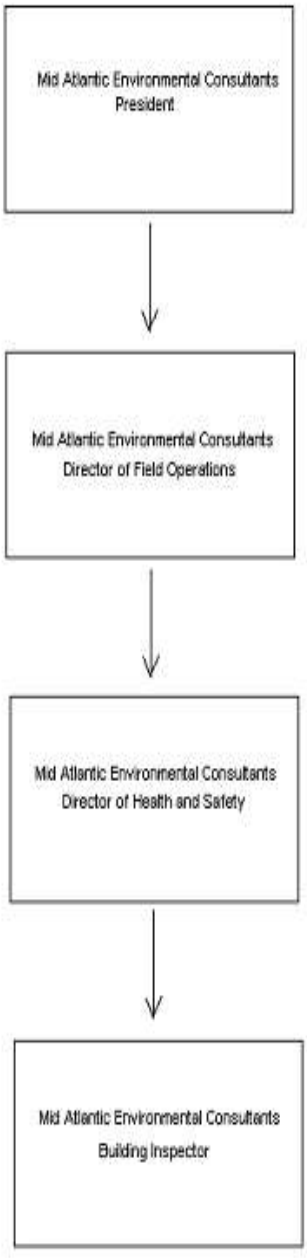
1.3 Other Local / State / Federal Agency Representatives and Their Roles Responsibilities

Remedial Contacts (REM)

The Remedial Contacts (REM) for this site is Civil & Environmental Consultants, Inc. The REM contractors are responsible for data collection activities solely for the remedial investigation (RI). REM contractors are also responsible for feasibility studies (FS), which culminate in RI/FS reports in support of EPA's remedial programs.

Figure 1-1 Organizational Chart

Mid-Atlantic Environmental Consultants Command Tree



2.0 JOB HAZARD ANALYSIS

(In compliance with 29 CFR 1910.120(b)(4)(ii)(A),and 1910.120(i))

This chapter of the HASP describes the safety and health hazards associated with site work and the control measures selected to protect workers. The purpose of a job hazard analysis (JHA) is to identify and quantify the health and safety hazards associated with each site task and operation, and to evaluate the risks to workers. Using this information, appropriate control methods are selected to eliminate the identified risks if possible, or to effectively control them. The control methods are documented in each task-specific JHA. The information contained in this chapter is essential to effective preparation of all other chapters of the HASP.

This section of the HASP includes:

* a site description
* job hazard analysis
* hazardous substance information
* employee notification of hazards

The person responsible for ongoing job hazard analysis for any specific site is Tim Daniels.

2.1 Site History

The following text describes the site and its conditions as they relate to the need to perform hazardous substance clean-up operations.

Site survey for building renovations / demolitions.

The sources used to provide the above description include:

- RFP provided to Mid Atlantic by Civil & Environmental Consultants, Inc. (residential and commercial buildings)

2.2 Job Hazard Analysis

Each site-specific JHA appears on a separate copy of Table 2-2. Each JHA lists a task or operation required during site clean-up and the location(s) where that task or operation is performed. A single JHA may be used for a task / operation performed in multiple locations if the hazards, potential exposures, and controls are the same in each location.

Each JHA lists the chemical hazards associated with that task and their known or anticipated airborne concentrations during performance of the task. Each JHA also identifies anticipated physical and biological hazards and potential exposure levels or the likelihood of exposure. The final section of each JHA lists the control measures implemented to protect employees from exposure to the identified hazards. The information provided here is designed to satisfy the job hazard analysis requirements of 1910.120(b)(4)(ii)(A); and the workplace hazard assessment requirements of 1910.132(d).

Health hazard information for all chemical substance identified in site JHAs appears in hazard data sheets attached to this chapter.

Tim Daniels modifies site-specific JHAs and the accompanying data sheets when:

- the scope of work is changed by adding, eliminating, or modifying tasks
- new methods of performing site tasks are selected
- observation of the performance of site tasks results in a revised characterization of the hazards
- new chemical or physical hazards are identified
- exposure data indicate changes in the concentration and/or likelihood of exposure
- new / different control measures are selected

When JHAs are modified, related provisions in other chapters of this HASP are modified as needed.

Table 2-2: Site-Specific Job Hazard Analysis

Operational Phase	Phase No	Task / Operation	Location Where Task / Operation Performed
Bulk Sampling	1	Site Survey	Throughout Site

Date(s) this JHA was Conducted	Employee Certifying this JHA		
July 2010			
	Print Name	**Signature**	

Chemical Hazards

Chemical Name	Source	Concentration	Exposure Limit
Asbestos, All Forms	Bulk Sampling	NA f/cc	0.1 f/cc PEL – TWA OSHA

**Chemicals added by user*

Physical Hazards

Name of Physical Hazard	Source	Exposure Level / Potential	Exposure Limit
No Physical Hazards		< 0.1 f/cc	0.1 f/cc PEL – TWA OSHA

Control Measures Used

Engineering Controls: Visual inspection will identify suspect material to be sample as well as the condition of the material.

Work Practices: Friable suspect material sampled will utilize amended water and 1/2 face respirator with P100 filters.

Level of PPE: C
Respirator Cartridge/Canister:
Particulates: P100
Service Life:
Task-Specific Modifications: None

2.3 Employee Notification of Hazards and Overall Site Information Program

The information in the JHAs and the attached data sheets is made available to all employees who could be affected by it prior to the time they begin their work activities. Modifications to JHAs and the accompanying data sheets are communicated during routine briefings.

Consistent with paragraph (i) of HAZWOPER, we also inform other contractors and subcontractors about the nature and level of hazardous substances at this site, and the likely degree of exposure to workers who participate in site operations.

The person responsible for providing site information, this HASP, and any modifications to the HASP to other contractors and subcontractors working on this site is: CEC Designated Personnel / CEC Site Project Manager(s).

CHEMICAL IDENTIFICATION

Chemical Name: ASBESTOS, ALL FORMS

CAS #: 1332-21-4 **UN No:** NA **Formula:** Hydrated mineral silicates

Synonyms: Actinolite, Actinolite asbestos, Amosite (cummingtonite-grunerite), Anthophyllite, Anthophyllite asbestos, Chrysotile, Crocidolite (Riebeckite), Tremolite, Tremolite asbestos

PHYSICAL PROPERTIES

Physical Description: White or greenish (chrysotile), blue (crocidolite), or brown (amosite) fibrous, odorless solids.

BP: Decomposes	MW: Varies	LEL: NA	NFPA Fire Rating: NA	
MLT: 1112ºF	VP: 0 mmHg (approx.)	UEL: NA	NFPA Health Rating: NA (Decomposes)	
Fl.P: NA	VD: NA		NFPA Reactivity Rating: NA	
Sp. Gr.: NA	IP: NA		NFPA Sp. Inst.: NA	

EXPOSURE GUIDELINES

OSHA		NIOSH		ACGIH		Related Information
PEL-TWA ppm:	NA	REL-TWA ppm:	NA	TLV-TWA ppm:	NA	AIHA Emergency Response Planning Guidelines (ERPGs) EPRG-1/EPRG-2 2/EPRG-3: NA
PEL-TWA mg/m3:	NA	REL-TWA mg/m3:	NA	TLV-TWA mg/m3:	NA	
PEL-STEL ppm:	NA	REL-STEL ppm:	NA	TLV-STEL ppm:	NA	
PEL-STEL mg/m3:	NA	REL-STEL mg/m3:	NA	TLV-STEL mg/m3:	NA	
PEL-C ppm:	NA	REL-C ppm:	NA	TLV-C ppm:	NA	
PEL-C mg/m3:	NA	REL-C mg/m3:	NA	TLV-C mg/m3:	NA	

Skin Notation: Not irritating

Notes: TWA = 0.1 f/cc, STEL = 1 f/cc (30 MINUTES); SEE 29 CFR 1910.1001	**Notes:** TWA = 0.1 f/cc AS DETERMINED BY A 400-LITER AIR SAMPLE COLLECTED OVER 100 MINUTES (NIOSH ANALYTICAL METHOD #7400); CARCINOGEN (Ca). USE 29 CFR 1910.1001	**Notes:** TWA = 0.1 f/cc, RESPIRABLE FIBERS: LENGTH > 5u; ASPECT RATIO >/= 3:1	**Carcinogen Classifications:** IARC-1, NIOSH-Ca, NTP-K, OSHA-Ca, TLV-A1, EPA-A

IDLH Notes: Ca

IDLH ppm: NA IDLH mg/m3: NA

HEALTH INFORMATION

Symptoms: dyspnea; interstitial fibrosis; restricted pulmonary functioning; (carcinogenic)
Health Effects: cancer; asbestosis
Target Organ: respiratory system / plural cavity

EMERGENCY RESPONSE INFORMATION

First Aid:

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Breathing: If a person breaths large amounts of this chemical, move the exposed person to fresh air at once. Other measures are usually unnecessary. (NIOSH, 1997)

Reactivity: This compound is incompatible with the following: None reported (NIOSH, 1997)

Nonfire Spill Response: Keep material out of water sources and sewers.

Land spill: Cover solids with a plastic sheet to prevent dissolving in rain or firefighting water. Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete.

Water spill: Use natural barriers or oil spill control booms to limit spill travel. (AAR, 1999)

Fire Response: Extinguish fire using agent suitable for type of surrounding fire. (Material itself does not burn or burns with difficulty.) Keep run-off water out of sewers and water sources. (AAR, 1999)

3.0 SITE CONTROL
(in compliance with 29 CFR 1910.120(b)(4)(ii)(F) and 29 CFR 1910.120(d))

This site control program is designed to reduce the spread of hazardous substances from contaminated areas to clean areas, to identify and isolate contaminated areas of the site, to facilitate emergency evacuation and medical care, to prevent unauthorized entry to the site, and to deter vandalism and theft.

The site control program includes the elements specified in 29 CFR 1910.120(d) and provides the following site-specific information:

- a site map, indicating site perimeter and work zones
- site access procedures
- site security
- use of the buddy system
- both internal (on-site) and external communications

Timothy Daniels is responsible for evaluating site conditions and for verifying that the site control program functions effectively. The site control program is updated regularly to reflect current site conditions, work operations, and procedures.

3.1 Site Map
A map of any project site, showing site boundaries, designated work zones, and points of entry and exit will be provided by client.

3. 2 Site Access
Access to this site is restricted to reduce the potential for exposure to its safety and health hazards. Entry and exit at these points is controlled by the following: Mid Atlantic Building Inspector. When the site is not operating, access to the site is controlled by the following: Building Owner or Building Owner Representative.

Visitors to the site register with Building Owner or Building Owner Representative, and are escorted at all times. Visitors are expected to comply with the requirements of this HASP. Visitors who want to enter contaminated areas of the site must provide documentation that they have the required training and medical evaluation and must receive a site-specific briefing about protecting themselves from site hazards, recognizing site zones demarcations, and following emergency evacuation procedures. All visitors must have PPE.

3.3 Site Security
Security at any site is maintained during both working hours and non-working hours to prevent unauthorized entry; removal of contaminated material from the exclusion zone; exposure of unauthorized, unprotected people to site hazards; and increased hazards due to vandalism and theft.

Security During Working Hours

Building Owner or Building Owner Representative is responsible for establishing and maintaining site security during working hours.
All project sites take the following measures for security during working hours:

1. Security is maintained in the Support Zone and at Access Control Points to ensure only authorized entrance access the site.

2. A fence or other physical barrier is erected around the perimeter of the site to prevent unauthorized entry or exit.

3. Signs have been posted around the perimeter of the site to warn of the site dangers and prohibition of unauthorized entry.

4. Site personnel patrol the perimeter of the site.

Security During Non-Working Hours

Building Owner or Building Owner Representative is responsible for establishing and maintaining site security during non-working hours. The following measures have been taken for security during non-working hours:

1. Trained in-house site personnel are used for site surveillance.
2. An outside contractor is used for site surveillance.
3. A local police department is used for site surveillance.
4. All doors to buildings and/or trailers are locked and equipment is secured.

3.4 Buddy System

While working, site workers use the buddy system. The buddy system means that personnel work in pairs and stay in close visual contact to be able to observe one another and summon rapid assistance in case of an emergency. The responsibilities of workers using the buddy system include:

- remaining in close visual contact with partner;
- providing partner with assistance as needed or requested;
- observing partner for signs of heat stress or other difficulties;
- periodically checking the integrity of partner's PPE; and
- notifying the site manager or other site personnel if emergency assistance is needed.

3.5 Site Communications

The following communication equipment is used to support on-site communications:

Telephones at project sites are located in the following areas:

To be established

A current list of emergency contact numbers is posted in the following locations:

To be established (usually at project site office)

In addition, site personnel are trained to recognize and use hand signals when visual contact is possible but noise or PPE inhibit voice communication. These hand signals are listed below in Table 3-6.

Table 3-6 Site Communication - Hand Signals

Signal	Meaning
Thumbs down	No

3.6 Emergency Medical Assistance

The nearest emergency medical assistance selected to support this site is:

Organization:
Contact:
Address/Location:
Telephone: 911

4.0 TRAINING PROGRAM
(in compliance with 29 CFR 1910.120(e))

This training program is consistent with the requirements of 29 CFR 1910.120(e) and addresses the following site-specific information:

- training for site workers
- site briefings for visitors and workers
- supervised field experience
- management and supervisor training
- qualification of trainers
- training certification
- refresher training

4.1a Training Elements to be Covered for Site Workers:

- names of personnel and alternates responsible for site safety and health
- safety, health and other hazards present on the site
- use of PPE
- work practices by which the employee can minimize risks from hazards
- safe use of engineering controls and equipment on the site
- medical surveillance requirements detailed in Chapter 5 of this HASP
- decontamination procedures detailed in Chapter 10 of this HASP
- the emergency response plan detailed in Chapter 11 of this HASP
- confined space entry procedures detailed in Chapter 13 of this HASP
- the spill containment program detailed in Chapter 9 of this HASP
- the site control plan detailed in Chapter 3 of this HASP

4.1b Site-Specific Briefings for Visitors

A site-specific briefing is provided to all site visitors who enter this site beyond the site entry point. For visitors, the site-specific briefing provides information about site hazards, the site lay-out including work zones and places of refuge, the emergency alarm system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate by the Building Owner or Building Owner Representative.

4.1c HASP Information and Site-Specific Briefings for Workers

Site personnel review this HASP and are provided a site-specific briefing prior to the commencement of work to ensure that employees are familiar with this HASP and the information and requirements it contains. Additional briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during ongoing site characterization and analysis. Conditions for which we schedule additional briefings include, but are not limited to: changes in site conditions, changes in the work schedule/plan, newly discovered hazards, and incidents occurring during site work.

4.2 Initial Training

Initial training requirements are based on a worker's potential for exposure and compliance with the requirements of 29 CFR 1910.120(e)(3).

4.3 Management and Supervisor Training

On-site managers and supervisors who are directly responsible for or who supervise workers engaged in Asbestos Bulk sampling receive, in addition to the appropriate level of Building Inspector training described above, 8 additional hours of Asbestos Management Planner training.

4.4 Qualification of Trainers

Only instructors qualified in accordance with 29 CFR 1910.120(e)(5) are used to train workers for this site. Qualified instructors have either completed a training program for teaching the subjects they are expected to teach or have the academic credentials and instructional experience necessary for teaching the subjects.

4.5 Training Certification

Employees and supervisors that receive and complete the necessary training and field experience are certified when they complete the necessary training. A written certificate is given to each person so certified. Any person who has not been so certified or who does not meet the requirements of equivalent training is prohibited from engaging in bulk sampling operations on this site.

4.6 Refresher Training

All workers on this site including managers and supervisors receive annual Building Inspector refresher training consistent with the requirements of 29 CFR 1910.120(e)(8).

5.0 MEDICAL SURVEILLANCE

(in compliance with 29 CFR 1910.120(f) and other substance-specific medical surveillance requirements found in 29 CFR 1910.1001-1052)

The medical surveillance section of the Health and Safety Plan describes how worker health status is monitored at this site.

Medical surveillance is used when there is the potential for worker exposure to hazardous substance at levels above OSHA permissible exposure limits or other published limits. The purpose of a medical surveillance program is to medically monitor worker health to ensure that personnel are not adversely affected by site hazards. The provisions for medical surveillance at this site are based on the site characterization and job hazard analysis found in Chapter 2 of this HASP and are consistent with OSHA requirements in 29 CFR 1910.120(f) and the following substance-specific requirements: ASBESTOS, ALL FORMS (1910.1001, 1926.1101).

The medical surveillance program is consistent with 29 CFR 1910.120(f) and addresses the following information:

- provisions of the site medical surveillance program
- communication between the site, physicians, and workers
- medical recordkeeping procedures

The person with responsibility for ensuring this program is implemented and maintained is Timothy Daniels.

5.1 Site Medical Surveillance Program

Medical surveillance requirements are based on a worker's potential for exposure as determined by the site characterization and job hazard analysis documented in Chapter 2 of this HASP and on compliance with the requirements of 29 CFR 1910.120(f)(2).

Medical examination for personnel within the medical surveillance program were determined by the site's attending physician and include the following:

Table 5-1 Medical Surveillance for Site Workers

Baseline Exam	Task/Operation	Medical Surveillance Requirements	Termination Exam
Pulmonary Function	Building Inspector	> 30 days exposure at or above limits	
Chest X-ray	Building Inspector	> 30 days exposure at or above limits (every 5 years under 50)	

5.2 Communication Between the Site, Physicians, and Workers

The medical facility providing medical monitoring and overexposure examinations required by personnel at this site is:

Name: H.A.P.P.I. – UPMC Passavant Cranberry
Location: 20130 Route 19 – Suite 2200 – Medical Office Building #6 – Cranberry Township, PA 16066
Phone: 724.772.5400
The licensed attending physician for this site is:
Name: H.A.P.P.I. – UPMC Passavant Cranberry
Phone: 724.772.5400

The site has provided information about site hazards and potential exposure levels, work activities, and PPE requirements, and other information as required by OSHA in 29 CFR 1910.120(f)(6) to the above-mentioned facility and physician. The site will also make this information available to site personnel and/or their personal physicians.

A physician's written opinion of the results of these examinations is required for each worker and a copy is maintained on site. The contents of the written opinion is limited to:

- a statement of the worker's health status in relation to his or her job duties and a description of any detected
- medical condition that could put the worker at increased risk.
- notation of any recommended limitations in work activity or PPE
- confirmation that the physician has informed the employee of the examination results and any further examination or treatment required.

5.3 Medical Recordkeeping Procedures

(in compliance with 29 CFR 1910.120(f)(8) and 1910.1020)

The following items are maintained in worker medical records:

Pulmonary Function

Chest X-ray every 5 years (yearly over 50)

5.4 Program Review

- review of accident and injury records and medical records to determine whether the causes of accidents and illness are promptly investigated and whether corrective measures are taken wherever possible;
- evaluation of the appropriateness of required medical tests on the basis of site exposures; and
- review of emergency treatment procedures and emergency contacts list to ensure they are site-specific, effective, and current.

6.0 PERSONAL PROTECTIVE EQUIPMENT

(in compliance with 29 CFR 1910.120(b)(4)(ii)(C) and 29 CFR 1910.120(g))

This chapter of the HASP describes how personal protective equipment (PPE) is used to protect against employee exposures to hazardous substances and hazardous conditions on this site. Exposure hazards from the decontamination process are also considered. The following topics are addressed in this chapter:

- PPE selection criteria
- Site-specific PPE ensembles
- Criteria for PPE upgrades and downgrades
- Procedures for determining work duration
- Training in use of PPE
- Respiratory protection
- Hearing conservation
- PPE maintenance & storage
- Evaluation of this program

The person with the overall responsibility for the PPE program is Timothy Daniels.

6.1 PPE Selection Criteria

Site safety and health hazards are eliminated or reduced to the greatest extent possible through engineering controls and work practices. Where hazards are still present, a combination of engineering controls, work practices, and PPE are used to protect employees.

An initial level of PPE is assigned to each task to provide an adequate barrier to exposure hazards. Initial PPE ensembles are selected based on the anticipated route(s) of entry of the hazardous substances on site and their concentration. Ensemble materials are selected using permeation data supplied by individual manufacturers. Materials providing the greatest duration of protection have been chosen. Tear and seam strength of the PPE are also considered to ensure ensemble durability while work is performed. When necessary, multiple layers of protection are used to accommodate the range of hazards that may be encountered. Where possible, employees are provided with a range of component sizes to ensure properly fitted PPE.

The following criteria are used in selecting PPE levels at this site.

Use of Level C Protection

Employees use Level C protection during tasks that have or potentially have the following characteristics:

- Atmospheric conditions, or other direct contact with hazardous substances exist or are likely but will not adversely affect or be absorbed through exposed skin.
- The atmosphere contains hazardous substances at concentrations which can be adequately controlled using an available air-purifying respirator and cartridge/canister.
- IDLH conditions are not present.
- The atmosphere contains between 19.5 and 23.5% oxygen.

In accordance with 29 CFR 1910.134(d)(3)(iii)(B)(2), a cartridge/canister change schedule has been determined. Cartridges and canisters used with air-purifying respirators on this site are replaced when any of the following occurs:

- a NIOSH-approved end of service life indicator (ESLI) is activated,
- the service life identified in this HASP has passed (see JHAs for service life determinations)
- inhalation is restricted

Use of Level D Protection

Employees use Level D protection during tasks that have the following characteristics:

- The atmosphere contains no known or suspected hazardous substances at concentrations that meet or exceed the published exposure limit.
- Contact with hazardous levels of any chemicals through splashes, immersion, or by other means will not occur.
- There is no potential for unexpected inhalation or contact with hazardous levels of any chemical.

6.2 Use of PPE

Site-specific PPE ensembles and materials are identified below in Table 6-2a. These ensembles are consistent with Appendix B of 29 CFR 1910.120. PPE is used in accordance with manufacturers' recommendations.

Table 6-2a Site-Specific PPE Ensembles

Equipment	Model	Material	Employee Purchased
Level C			
Respiratory Protection: Half-face air purifying	North	P100 Filters	No
Hooded chemical resistant clothing: Over-suit	Disposable	Tyvec	No
Boots: Steel Toe	NA		No
Level D			No
Coveralls / Standard Work Clothes	NA	NA	No
Boots / Shoes: Steel Toe	NA	NA	No
Respirator	North ½ Face or equivalent	P100 Filters	No
Safety Glasses	Pyramex or equivalent	High Impact	No
Hard Hat	Fiber Metal or equivalent		No

Criteria for PPE Upgrades and Downgrades

Table 6-2b below shows the action level(s) and/or conditions that result in a PPE upgrade or downgrade at this site.

These upgrades and downgrades are required for any employee wearing the level of PPE described below. Since PPE is primarily used as a barrier to hazardous substance exposure, airborne concentrations are monitored routinely, in accordance with Chapter 7, Exposure Monitoring.

Table 6-2b Action Levels / Conditions for PPE Upgrades and Downgrades

Initial Level of PPE	Upgrade Action Level / Conditions	PPE Modifications Requires
	PPE Upgrades	
Level B	None	
Level C	None	
Level D	None	
	PPE Downgrades	
Level A	None	
Level B	None	
Level C	TSI: no matrix disturbance	No respirator

Tim Daniels has the authority to upgrade or downgrade PPE in a timely manner to respond to changing site conditions and to protect employee health and safety. Routine evaluation of the effectiveness of the PPE program is conducted as identified in Section 6.7 below.

Procedures for Determining Work Duration

Tim Daniels identifies task-specific work duration based on the following:

- Physiological requirements of the task
- PPE level for the task
- Ambient temperature and humidity
- Respiratory protection capacity (air supply or cartridge change requirements)
- Acclimatization of the work force

Employees are informed about task-specific work duration by Memo or verbal command.

Work duration is consistent with the requirements outlined in Chapter 8, Thermal Stress and the respiratory protection capacity for the assigned PPE. Work duration is continuously re-evaluated in response to changes in working conditions.

6.3 Training

Employees receive general training regarding proper selection, use and inspection of PPE during initial HAZWOPER training (or equivalent) and subsequent refresher training. Site-specific PPE requirements, including task-specific PPE, ensemble components, cartridge/canister service times, and inspection and maintenance procedures are communicated as identified in Chapter 4, Training.

6.4 Respiratory Protection

The type of respiratory protection used on site are identified in Table 6-2a. Respiratory protection is selected, fitted, used, stored and maintained in accordance with the Respiratory Protection Program. A copy of the Respiratory Protection Program is located in/at [Mid Atlantic]. The written Respiratory Protection Program is consistent with the other requirements of this HASP.

6.5 Hearing Conservation

Employees must use hearing protection when noise exposures equal or exceed an 8-hour time-weighted average sound level of 85 dBA. Where noise exposure meets or exceeds this level, noise is listed as a physical hazard in the JHA for the tasks/operation, and hearing protection is included as one of the control measures (PPE). Employees required to use hearing protection participate in a Hearing Conservation Program.

Currently, no site tasks have noise exposure that equals or exceeds the 85 dBA limit.

6.6 PPE Maintenance & Storage

Table 6-6 describes the PPE maintenance schedule. The person responsible for overseeing PPE maintenance & storage procedures and for maintaining the inspection record is Timothy Daniels.

Table 6-6 PPE Maintenance

Type of PPE	Model	Inspection Frequency	Done by:	Cleaning Frequency	Done by:
Level C					
Component	Disposable Suits	Single Use	Self	Single Use	Single Use
Respiratory Protection	North	Daily	Self	Per Use	Self
Level D					
Component	NA				
Component	NA				
Safety Glasses	Pyramex or equivalent	Daily	Self	Per Use	Self
Hard Hat	Fiber Metal or equivalent				
Respirator	North ½ Face or equivalent	Daily	Self	Per Use	Self

Defective or damaged equipment is not used and is reported to Tim Daniels so that the equipment can be repaired or discarded.

Spent and disposable PPE is discarded in the manner specified in Chapter 10, Decontamination. After decontamination, reusable PPE is properly stored, according to the manufacturers' recommendations.

6.7 Evaluation of PPE Program

Evaluation of the effectiveness of site PPE selections occurs throughout site activities in response employee exposure monitoring results and employee feedback. Surface monitoring procedures are described in Chapter 7 of this HASP, Exposure Monitoring.

Tim Daniels is responsible for modifying initially selected PPE. Affected employees are immediately informed about these modifications and are provided with additional training if necessary. The JHAs in Chapter 2 of the HASP are also updated as needed to reflect current information about job hazards and selected controls.

7.0 EXPOSURE MONITORING

(in compliance with 29 CFR 1910.120(b)(4)(ii)(E) and 29 CFR 1910.120(h))

This chapter of the HASP describes how employee exposures to hazardous substances are monitored. This chapter provides site-specific information about:

- air monitoring procedures;
- surface sampling procedures;
- equipment calibration and maintenance; and
- the handling and management of monitoring data.

Tim Daniels is responsible for implementing site exposure monitoring procedures.

The following personnel are qualified to use the air monitoring instruments at this site and to interpret monitoring results:

Monitoring Instrument

Timothy Daniels
Dennis Gillespie

Edgar King

Joe Pillart

Mike Pirro

Rich Bitar

Nazeer Elahee II

The following personnel are qualified to conduct surface sampling at this site and to interpret surface sampling results:

- Edgar King
- Timothy Daniels
- Dennis Gillespie
- Joe Pillart
- Mike Pirro
- Richard Bitar
- Nazeer Elahee II

7.1 Air Monitoring

Employee exposures to airborne hazardous substances are fully characterized throughout site operations to ensure that exposure controls are effectively chosen and modified as needed on a timely basis. The approach to air monitoring is consistent with OSHA requirements in HAZWOPER and includes:

- initial monitoring prior to the beginning of site activities to identify conditions that may cause death or serious harm and to permit preliminary selection of site controls;
- personal monitoring after site activities begin so that employee exposures are quantified and fully characterized; and
- periodic monitoring throughout site operations when conditions and employee exposures may change rapidly. This can include, but is not limited to, the following situations:
    - commencement of work on another portion of the site;
    - exposure to or handling of contaminants/hazards not previously identified;
    - commencement of a new task/operation;
    - change in environmental conditions; and
    - commencement of task/operation that is likely to increase airborne concentrations of hazardous substances.

Air monitoring is conducted using direct-reading instruments and by collecting and analyzing personal samples. Consistent with OSHA, personal air samples are collected in the breathing zones of employees expected to have the highest exposure during the task or operation being evaluated. If exposures for

these employees exceed the exposure limits, additional samples are collected in the breathing zones of all employees likely to have similar exposures. Full-shift and short-term samples are collected, providing quantitative results that can be compared to OSHA Permissible Exposure Limits and other published exposure limits. In addition, the results of lab-analyzed samples are correlated with direct-reading monitoring results to ensure that direct-reading results are interpreted correctly.

Project sites may contain contaminants addressed in one or more of OSHA's substance-specific standards, specifically ASBESTOS, ALL FORMS. Site monitoring procedures comply with OSHA's substance-specific requirements.

7.2 Surface Sampling

Surface sampling is used as needed in contaminated areas to evaluate potential employee exposures.

Surface concentrations in excess of the established limits may result in adjustments of PPE, decontamination procedures, site zone boundaries, and other exposure controls. Tim Daniels is responsible for evaluating surface sampling results and determining corrective actions if sample results indicate contaminant levels in excess of permissible surface concentration.

7.3 Equipment Calibration and Maintenance

Table 7-3 lists the specific monitoring instruments and the calibration procedures. Instruments are calibrated and maintained according to the manufacturers' recommendations. Copies of the manufacturers' recommendations and instrument calibration and maintenance records are maintained in the following location(s): Mid Atlantic's corporate office.

Table 7-3 Equipment Calibration & Maintenance

Instrument: Personal sampling pumps

Serial Number	Field Calibration Method	Field Calibration Frequency	Manufacturer Recalibration Date
500159	Rotameter	Before and after each use	12/14/2016

7.4 Handling and Maintenance of Monitoring Data

Procedures for collecting, handling, and shipping laboratory samples are included in Chapter 12 of the Standard Operating Practices.
Documentation procedures for analytical results and direct-reading monitoring data are also addressed in Chapter 12 of the Standard Operating Practices. Samples are shipped to and analyzed by the laboratories listed in Table 7-4 below:

Table 7-4 Laboratory Information

Laboratory Name: Mid Atlantic Environmental Consultants, Inc.
Address: 5320 N Pioneer Road
Gibsonia PA, 15044
Telephone: (724) 444-3460
Laboratory Contact: Tim Daniels

Laboratory results are available within three (3) days of sample collection. Employees may review general air and surface monitoring results and may obtain copies of their personal monitoring results. Results from lab-analyzed samples are stored on site in/at: Mid Atlantic Environmental Consultants, Inc. Direct-reading monitoring results are documented and stored in/at: Mid Atlantic Environmental Consultants, Inc.

Employees who participated in an air monitoring event receive written notification of their respective personal exposures within 1 working day of receipt of results. Tim Daniels is responsible for providing employees with copies of their exposure monitoring results and interpreting all pertinent information.

APPENDIX D

MID-ATLANTIC ENVIRONMENTAL CONSULTANTS, INC.
GUIDELINES FOR AN ASBESTOS SURVEY

MID ATLANTIC ENVIRONMENTAL CONSULTANTS, INC.
GIBSONIA, PENNSYLVANIA

GUIDELINES FOR AN ASBESTOS SURVEY

PREPARED BY:

MID ATLANTIC ENVIRONMENTAL CONSULTANTS, INC.
5320 NORTH PIONEER ROAD
GIBSONIA, PA 15044
PHONE: 724-444-3460
FAX: 724-444-3463
EMAIL: MIDATLANTIC@ZOOMINTERNET.NET

MID ATLANTIC ENVIRONMENTAL CONSULTANT INC.'s GUIDELINES FOR AN ASBESTOS SURVEY

Field Procedures

- Review any existing information about the structure including design drawings, as-built drawing, project specifications, and any existing survey and / or laboratory information.
- Utilize the proper equipment in order to examine all accessible spaces (i.e ladders, flashlights, etc…)
- Confirm with the Owner or Owner's Representative the exact are under investigation, exact nature of demolition / renovation and identify all materials that will be disturbed or accessed.
- Determine the extent to which the building will be renovated and / or demolished.
- Determine and investigate each building's structural, mechanical, electrical and roofing systems.
- Perform a comprehensive investigation of areas to identify materials to be sampled and / or assumed to contain asbestos.
- Clearly note uninspected areas and explain why they were not surveyed (i.e. "confined space" buried material, restrictions generated by the property owner, etc…)
- Create sampling plan based on suspect materials present and requirements of 40 CFR 763-85 & 763.86.
- If requested, destructive sampling / investigation will be performed to look for hidden materials.
- Collect bulk samples of all suspect materials that will be disturbed and submit to a certified laboratory for analysis. Insure that each individual sample is allotted a specific identification number which shall be transcribed onto a chain of custody form for submittal to the analytical laboratory.
- Document where asbestos material exists and record their approximate location, condition and approximate quantity.

Survey Report Content

Scope of Work:

- Date(s) of field inspection
- Date of report submittal
- Building address
- Building Owner including address and contact person
- Description of area surveyed including any exclusions or limitations
- Name or report writer(s) and reviewer(s) including AHERA accreditation information

Building Description:

- Building name, if any
- Type of building (e.g. commercial, warehouse, retail, residential, etc…)
- Specific features of building
- Type of business
- Approximate age of structures and dates of past renovations
- Building Systems such as structural system, mechanical system, roofing sytem, non-structural systems, miscellaneous information, etc…

Building Inspector / Firm Affiliation / Laboratory Information:

- Names(s) of Building Inspector(s) including certification number and certification expiration date
- Inspector firm information including name, address, and phone number
- Laboratory name and certification
- Special instructions regarding type of analysis requested such as PLM, point counting, or TEM

Survey Methodology:

- Description of inspection procedure, including scope of survey. Inspection must be in accordance with the sampling protocol in 40 CFR 763.85 and 763.86.
- If hidden or inaccessible areas are to be disturbed or are likely to be disturbed, a destructive investigation must be performed. Provide a detailed description of the procedure used to find hidden suspect materials. For example, if asbestos pipe insulation is suspected in a wall cavity, describe by location where the wall was opened for examination. It is recommended that each building and non-structural system suspected of having asbestos materials be sampled at minimum of three locations.
- Description of sampling methods.

Asbestos Identification Process:

- Prepare sample and suspect asbestos material location plan.
- List all material sampled and tested.
- List all material assumed to contained asbestos.
- Indicate type and amount of material sampled, be specific.
- Describe suspect material location, friability, and approximate location.
- List all materials not sampled and state why they were not sampled.

APPENDIX E

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
STANDARD OPERATING PROCEDURES

03-01-04 SURFACE SOIL

I. SCOPE AND APPLICABILITY

This procedure describes manual collection of samples of surface soil.

II. PROJECT SPECIFIC REQUIREMENTS

A. Sample Locations:

B. Sample Numbering System:

C. Analytical Parameters:

D. Quality-Assurance Samples:

E. Field Screening:

F. Other Considerations:

III. METHODOLOGY

A. Clear the sample area of vegetation.

B. Use a clean stainless-steel trowel to loosen the soil to a depth of less than six inches.

C. Immediately prepare sample volume necessary for screening identified in Section II.E.

D. Classify the sample in accordance with SOP 02-03-01.

E. If composite samples are to be prepared, place an equal volume from each subsample into a decontaminated stainless-steel bucket and mix thoroughly.

F. Fill any sample jars required under Section II.C. above. Fill VOA vials first (if conducting VOC analyses), disturbing the sample as little as possible. Thereafter, the sample may be homogenized before filling the other sample jars. Immediately preserve the samples in accordance with SOP 07-01-02. If samples for VOCs are to be collected in accordance with Method 5035, disregard the above directions and follow the procedures outlined in SOP 03-01-05.

G. Prepare QA samples in accordance with SOPs 04-01-00 and 04-02-01.

H. Decontaminate equipment in accordance with SOP 01-01-00.

IV. PRECAUTIONS AND COMMON PROBLEMS

Avoid sampling obviously localized areas of impact (i.e. small stains) not representative of the area to be characterized by the soil sampling program. Contact the project manager for questions related to the sampling program objectives and related field observations.

V. DOCUMENTATION

In the Trip Report for the activity, include the date, time, and method of sample shipment, as well as steps taken to preserve samples; sample descriptions; and results of field screening.

IV. REFERENCES - None

03-01-05 SOIL SAMPLE COLLECTION USING TO COMPLY WITH SW846-5035 FOR VOC ANALYSIS

I. SCOPE AND APPLICABILITY: This procedure is applicable to the collection of soil samples for analysis by EPA Method 5035 for volatile organic compounds using Terra Core™ (field preservation) or EnCore™ sampling methods. This procedure is used to collect approximately 5 grams of soil for shipment to the laboratory for preservation and analysis.

II. METHODOLOGY:

A. FIELD PRESERVED SAMPLES USING TERRA CORE™

1. Use one Terra Core™ kit for each VOC sample location. This kit includes the Terra Core™ plunger, one 40 ml vial with methanol preservative, two 40 ml vials of sodium bisulfate preservative, one 60 ml amber glass bottle with a Teflon lid (for percent moisture determination). These are all contained in a foam bottle holder, sealed in plastic, and enclosed in a zipped plastic bag (Exhibit 03-05-01a). The bottles with preservative are pre-weighed to allow determination of sample weight.

2. Label each vial and bottle with the appropriate identification information.

3. With the plunger seated into the handle push the Terra Core™ sampler into the freshly exposed soil until the chamber is full. The sampler is designed to collect approximately 5g when full.

4. Wipe away all solids or debris from the outside of the sampler. The soil plug should be flush with the open end of the sampler.

5. Rotate the plunger 90^{o} until it is aligned with the slots in the body of the sampler. Place the open end of the sampler into one of the 40 ml vials containing the applicable preservative and slowly extrude the soil plug by pushing the plunger down.

6. Wipe away any soil or debris from the threads prior to placing the lid on the vial. Replace the vial in the foam carrier supplied with the kit.

7. Repeat steps 2 through 5 for each vial.

8. Fill the amber bottle with soil, allowing a minimum of headspace in the jar. Label the bottle with the same location identification as the associated Terra Core™ samples. This aliquot will be analyzed for moisture content. Place in the foam carrier.

9. Return the vials and foam carrier to the plastic bag and seal.

10. Place the entire kit in a cooler with ice.

11. Discard the plunger. Use a new kit and plunger for each sample location.

B. ENCORE SAMPLES

At least three EnCore™ samples (Exhibit 03-01-05) must be collected for each sample location. If laboratory QA/QC samples are specified in Section II.C.1, a total of seven samples will be needed. Each sampler is a single-use device and cannot be cleaned and/or reused. A sample must also be collected in a wide-mouth jar for moisture determination.

1. Retrieve a sample as specified in Section II.A. If collecting a surficial ample, clear the surface of vegetation and debris, but do not remove a sample.

2. Remove three EnCore™ samples from their sealed plastic/aluminized bags. Retain the bags for storage of the samplers after filling.

3. Before filling the samplers:

a. Hold the coring body and push the plunger rod down until the small O-ring rests against the tabs (Exhibit 03-05-01). This will assure that the plunger moves freely.

b. Place EnCore™ sampler on the T-handle. First depress the locking lever on the EnCore™ T-handle. Place the coring body, plunger end first, into the open end of the T-handle. Align the two slots on the coring body to the two locking pins in the T-handle. Twist the coring body clockwise to lock pins in the slots. Check that the sampler is locked in place.

4. To collect a sample, position the T-handle/sampler assembly with the coring body down. Using the T-handle, push the sampler into the sample or sampling surface until the coring body is completely full. When the coring body is full, the small O-ring will be centered in the viewing hole on the T-handle.

5. Remove the sampler from the sampled medium. Wipe off excess soil from the coring body exterior.

6. Cap the coring body while it is still on the T-handle. Push and twist the cap over the bottom of the coring body until grooves on the locking arms seat over the ridge on the coring body (Exhibit 03-05-01).

7. Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler.

8. Lock the plunger by rotating the extended plunger rod fully counter-clockwise until the wings rest firmly against the tabs (Exhibit 03-05-01).

9. Attach a completed circular label (provided on the EnCore™ sampler bag) to the cap on the coring body. Write the sample number on the label in indelible ink.

10. Return the full EnCore™ sampler to the zipper bag. Squeeze to displace excess air. Seal the bag and place it in a cooler with ice.

11. At each sampling location repeat steps C through K as necessary to fill the appropriate number of EnCore™ samplers. Label each sampler with the same location identification.

12. Fill a 125-mL wide-mouth jar with soil, allowing a minimum of headspace in the jar. Label the bottle with the same location identification as the associated EnCore™ samples. This aliquot will be analyzed for moisture content.

III. PRECAUTIONS AND COMMON PROBLEMS

A. The holding time for an Encore sampler is 48 hours. The Terra Core samples, since they are preserved, have a 14 day holding time. Plan accordingly.

B. The Encore cap may be difficult to place on the coring body. Tap it on if necessary.

C. When filling multiple Encore samplers from a single split-spoon, make the subsamples as similar as possible. Do not collect subsamples of different lithologies or soil types within one group.

D. Do not forget to include the moisture sample with the shipment.

IV. DOCUMENTATION

A. Additional information must be included in the Chain-of-Custody than for other analyses. Indicate how many samplers per sample location and specify laboratory QA/QC. Also, by this method, a sample for moisture determination is a separate bottle, instead of the same container as for chemical analysis.

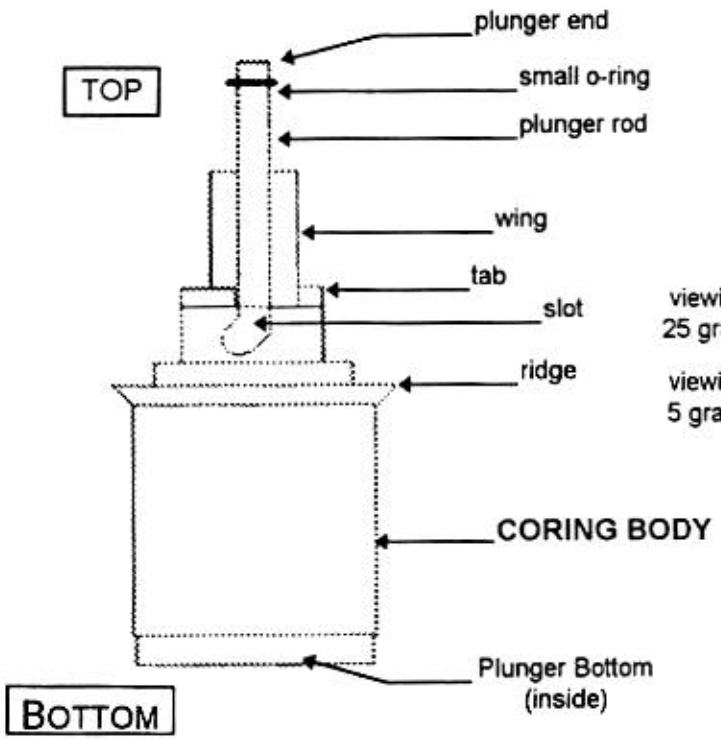
B. For each sample location, record the location identification number and the number of Terra Core or EnCore™ samples collected in a field log book. Include this information in a trip report with date, time, and material description.

V. REFERENCES:

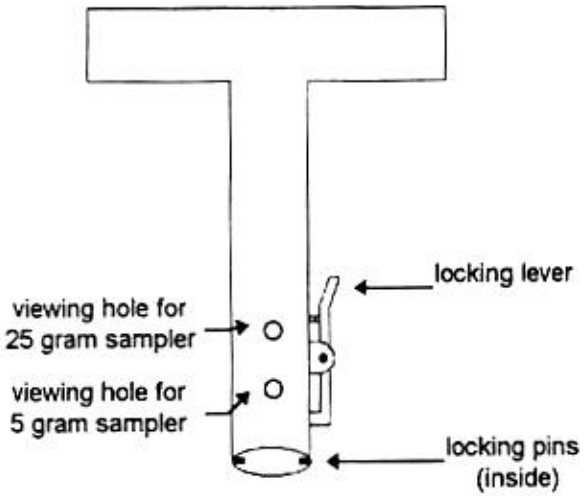
EPA Method 5035: Soil Sampling Guidance for Samples to be Analyzed Using Methods 8021, 8015, and 8260.

EnCore™ Sampler Sampling Procedures, En Novative Technologies, Inc.

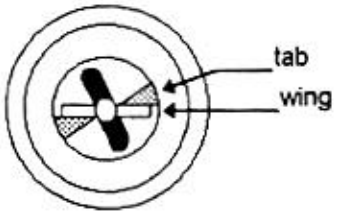
En Core Sampler



En Core T-Handle

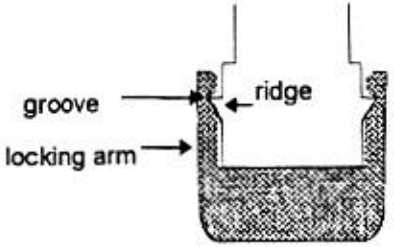


Locked Plunger



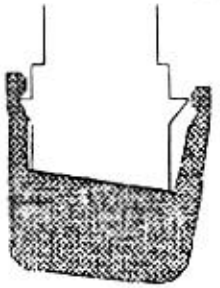
Sampler Correctly Capped

(Locking Arm Grooves Seated Over Coring Body Ridge)



Sampler Incorrectly Capped

(Cap Appears Crooked; Locking Arm Grooves Not Fully Seated Over Coring Body Ridge)



04-02-02 SOLID FIELD DUPLICATES

I. SCOPE AND APPLICABILITY

Field duplicate samples (may be called replicates by some regulatory programs) are a type of field quality control sample collected to evaluate the precision involved in the sampling effort and laboratory analysis. Solid field duplicates are field samples obtained from the same sampling location that are divided into separate containers, labeled and treated as separate samples throughout the remaining sample handling and analytical processes. These samples are used to assess total error (precision) associated with sample heterogeneity, sampling methodology, and analytical procedures. Field duplicate samples must be collected in a manner to be as similar as possible to the original sample. This procedure is applicable of collection of duplicate samples of granular solids such as soils, drill cuttings, and some bulk materials

II. PROJECT-SPECIFIC REQUIREMENTS

A. **Number/Frequency of Duplicate Sampling:** Duplicate collection frequency is dictated by the project Data Quality Objectives (DQOs). Collection of sample duplicates may not be considered necessary for all projects, especially those associated with routine monitoring.

B. **Duplicate Numbering System**: Unless field duplicates are being submitted as a test of the laboratory, it is typically not necessary to create a fake sample location and submit them "blind" to the laboratory. In most cases for ease of later reporting, the sample identification could be the "original sample ID-DUP" or just "DUP-mmddyy" for example. It is recommended to not create overly complex sample IDs as this may pose problems in the field and the laboratory.

III. METHODOLOGY

A. Prepare sample bottles for the target sample and its duplicate.

B. Collecting duplicate samples in a soil/sediment/solid matrix requires homogenization of the sample aliquot prior to filling sample containers. However, volatile organic samples must always be taken from discrete co-located areas or intervals without compositing or mixing. This practice is necessary to prevent loss of volatile constituents and to preserve, to the extent practicable, the physical integrity of the volatile fraction.

C. Collect the solid sample in accordance with the appropriate SOP.

D. Immediately fill VOA vials for the sample and duplicate, placing similar distributions of materials in both containers. If other analyses for volatile components are to be conducted, prepare these aliquots in the same manner.

E. Homogenization of the sample for remaining parameters is necessary to generate two equally representative samples. Note that enough sample material must be collected at one time in order to fill all the necessary sample containers. It may be necessary to co-locate or depth-integrate collection so enough sample volume is available. Homogenization should be accomplished by filling a properly decontaminated (preferably stainless steel) tray or bowl with the sample and mixing it with a decontaminated stainless steel or Teflon® instrument. The extent of mixing required will depend on the nature of the sample and should be done to achieve a consistent physical appearance prior to filling sample containers.

F. Gather sample into a pile, then cut it down the center to create two equal piles. Repeat this procedure until enough subsamples have been produced to fill all of the sample jars. Alternate filling the jars for the original sample and its duplicate.

G. Package and handle the samples in accordance with the appropriate SOP.

IV. PRECAUTIONS AND COMMON PROBLEMS

Failure to properly split the sample will result in poor correlation between analyses. Step III.F must be followed without creating bias in the sample.

V. DOCUMENTATION

List the sample and duplicate on the boring or test-pit log as separate samples, describing the duplicate in the "Comments" column. If a log is not appropriate, incorporate this information into the Trip Report (SOP 06-02-05). Enter both samples on the laboratory Chain of Custody form. The sample date and time should be filled in for the duplicate sample regardless of whether it is being submitted blind to the laboratory. Do not leave it blank as laboratories have different procedures in how they handle incomplete sample collection fields which may impact holding times for samples.

VI. REFERENCES

New Jersey Department of Environmental Protection, *Field Sampling Procedures Manual*, *Chapter 2 (Quality Assurance)*, August 2005. *http://www.nj.gov/dep/srp/guidance/fspm/*

04-01-01 FIELD BLANKS

I. SCOPE AND APPLICABILITY

The purpose of a blank in general is to evaluate artificially introduced sources of contamination. Field blanks are part of a continuum of blank types that may be used to monitor for contamination introduced throughout the life span of a sample from collection through to analysis (see Exhibit 1). Examples of field blanks include equipment blanks, lot checks of dedicated sampling equipment, bottle blanks, transfer blanks, decontamination/rinsate source blanks and trip blanks (see 04-01-02).

A. Equipment Blanks are collected to assess the adequacy of decontamination procedures for non-dedicated sampling equipment and may help evaluate whether field conditions, and/or sampling equipment, sample transport, preparation and/or analysis are contributing contaminants to samples. Equipment blanks are typically performed on non-dedicated sampling equipment that requires decontamination between uses. Equipment blanks should not be collected near running machinery which may emit fumes that can contaminate the blanks
.

B. Lot Checks are rinsates of disposable sampling equipment analyzed for the target analytes of interest that are sampled using that equipment. This may include peristolic tubing, sampling scoops or bailers as well as the empty bottles provided by the laboratory if there are concerns with their purity.

C. Transfer Blanks are empty sample containers filled with water in the field to monitor for ambient contamination - they most typically are used for aqueous samples for organics such as volatiles, GRO, and DRO but may also be useful if airborne particulates are of concern for inorganic parameters. The water source should be the same as what will be used for the final rinse of decontaminated field equipment (see 04-04-01).

D. Decontamination/Rinsate Source Blanks are samples created from the source of final rinsate water used in the field. They differ from Transfer Blanks in that they would typically be filled in a "clean" location as opposed to the field to avoid picking up unexpected ambient contamination. This type of blank, while rare, typically is utilized when an unexplained and persistent contaminant has been detected in the equipment blanks and all other potential sources of contamination have been eliminated as the source.

II. PROJECT-SPECIFIC REQUIREMENTS

WATER TYPES TO BE USED FOR BLANKS: Blank water refers to water that is free of any analytes of interest. Common water types include distilled, deionized, HPLC-grade, pesticide grade etc. Depending on the data quality objectives for the project and expected levels of target analytes, the choice of water used for field blanks water may vary. Investigations where trace levels (parts per billion or lower) of contaminant are of interest may require water that meets higher purity standards than soil investigations where target analytes may be in the parts per million range.

Sources of water suitable for use for field blanks include:

A. **Laboratory supplied water** is laboratory reagent water that is used in the analytical or cleaning processes, as well as for their method blanks. For the best comparability between field blanks and laboratory method or instrument blanks it is recommended that laboratory supplied water be used. This water should be in glass containers if organics analytes are of interest. In addition, this water should be from the laboratory performing the analyses and not left over from a prior investigation or from a different laboratory. This eliminates any variability introduced as a result of different blank water sources. Left over water from a previous project is not recommended for use as a field blank as the possibility exists that the water could have become contaminated during storage.

B. **Store purchased distilled/deionized**: If trace level analyses are not required, the use of commercially prepared distilled/deionized water purchased from a supermarket or home improvement store may be sufficient. As this water typically is available in plastic jugs, it is not an appropriate blank water source when trace level organics are the constituents of interest.

C. **Ultra Pure**: Certified metal-grade, pesticide-grade or HPLC-grade water may be purchased from most chemical supply companies.

III. METHODOLOGY

A. Review the SOP for the medium sampled, the project specific field sampling plan or quality assurance project plan to determine the blank collection frequency required for the project. Due to cost or other considerations, every project may not warrant the use of an equipment blank. Considerations impacting the frequency of equipment blank collection may include expected concentration ranges of the analytes of interest, field conditions (i.e. will sampling activities occur in an area where there are potential background ambient concentrations of target analytes), use of new sampling equipment, newly trained staff, or use of an unknown laboratory. Field blanks may also be collected if unexpected results in field samples are observed.

B. Record the source, date opened and lot number of the water used for the rinsate blanks.

C. Assemble a complete set of decontaminated sampling equipment for the subject sampling effort.

D. Rinse the blank water across the sampling equipment, catching it in a decontaminated stainless-steel bucket or bowl. Handle the water in the same manner as the samples. For example, if samples for metals analysis are to be filtered with a disposable filter, the blank aliquot for metals analysis should be processed through a new disposable filter. Blanks for soil sampling may be run across the split-spoon sampler, trowel, and bucket and/or bowl used for homogenizing.

E. Fill a complete set of sample bottles.

F. Assign the blank a sample id – if it is desirable to obscure the fact that the sample is a blank, use the same format as the other samples in the series, otherwise a simplified sample id such as FB-mmddyy is recommended (where FB could be EB, TRB, LC etc. as appropriate for the blank type).

G. Assign the blank a sample date and time. Laboratory protocols for assigning sampling date/time to improperly labeled samples vary widely and may impact sampling holding times for certain short hold parameters.

H. Include the blanks on the Chain of Custody form along with the other samples.

I. Store, handle, and ship the blanks in the same manner as the samples.

IV. PRECAUTIONS AND COMMON PROBLEMS

A. The selection of stock blank water depends upon the requirements of the project. Analyses for trace contaminants will require a purer blank solution than analyses for major constituents. Stringent analytical requirements will necessitate the use of laboratory-supplied blank water.

B. Include ALL sampling equipment in the rinsing procedure.

V. DOCUMENTATION: Record the following information in the field logbook:

- Source of blank water (include a lot number if available and the type of sample container)
- Time and sequence within the sampling event when the blanks were prepared

- Description of the procedure for preparing the blanks
- Sample numbers assigned to blanks.

Incorporate this information into the Trip Report (SOP 06-02-05).

VI. REFERENCES

EPA, 1986. Test Methods for Evaluating Solid Waste: SW-846; Volume I, Chapter I. Washington, DC.
EPA, 2009. Region III Fact Sheet: Quality Control Tool – Blanks
(http://www.epa.gov/region3/esc/qa/pdf/blanks.pdf)

04-01-02 TRIP BLANKS

I. SCOPE AND APPLICABILITY

A trip blank is a container of laboratory reagent water that is prepared by the laboratory and shipped, unopened, to the field with empty sample containers and then from the field along with the full sample containers. Trip blanks are used to document contamination attributable to shipping and field handling procedures (i.e., diffusion of volatile organics through the septum during daily collection activities, shipment and storage) as well as provide an independent assessment of laboratory introduced contamination. If the trip blank and associated laboratory preparation blanks are free of analytes of interest, it may safely be assumed that reported analytes are actually present in the environmental samples.

II. PROJECT-SPECIFIC REQUIREMENTS

A. Frequency: *Specify the project specific frequency based on the Work Plan.*

B. Other Criteria: A trip blank is used for all classes of volatile organic analyte analyses (VOA), such as TCL volatile organic compounds (VOCs), BTEX, methanol or other purgeable organic compounds. If you are unsure whether a specific analysis is considered a purgeable method, confirm with the laboratory.

1. Trip blanks are also required for soil samples submitted for TPH-gasoline range organics and other purgeable organics analyses (VOAs). These trip blanks should be prepared in the same manner as an aqueous trip blank.
2. If some of the daily samples being collected/shipped together are submitted for typical VOCs (SW846-8260 or EPA 624) while others are submitted for TPH gasoline/diesel range organics (or another purgeable organic method), you will need to include 2 sets of trip blanks and analyze one for each unique (non-overlapping analyte list) method.

C. Other Considerations: Even if the project Work Plan doesn't specifically call for the use of Trip Blanks there are certain situations where the use of a Trip Blank should be evaluated:

1. If an unexpected high field PID reading is encountered during sampling, a trip blank may be warranted to monitor for cross contamination if other samples are included in the shipment.
2. When there is suspicion of the potential of airborne contamination from external sources such as idling vehicles or machinery or operations upwind using VOCs (such as a refinery, spray painting etc.) although such contamination is best monitored for using a transfer blank where the VOA vial is filled in the field with the water used for equipment rinsate blanks.
3. In general, if there is a suspicion of external cross contamination, a trip blank could be submitted to the laboratory to be placed on HOLD. If unexpected results are encountered in the other samples in the shipment, the laboratory can then be requested to analyze the trip blank to determine whether cross contamination has occurred however holding times must be closely monitored in such cases.

III. METHODOLOGY

For those projects where trip blanks are required, appropriate procedures are discussed below:

A. One trip blank should be included with each cooler containing volatile samples. To save on trip blank analysis costs, you may collect all volatile samples during the day in a single cooler and ship them separately from other sample bottles (if necessary to minimize the number of trip blanks required).

B. When ordering bottles from the laboratory for the sampling event, request sufficient trip blanks such that there is at least one trip blank associated with each day of sample collection activities (with a few spares as a contingency if unexpected conditions expand the field activities or a trip blank container breaks).

C. A trip blank is associated with a group of samples that are collected together throughout the day and shipped together. (It is not necessary to maintain the trip blanks with the same set(s) of vials that are shipped <u>from</u> the laboratory, unless there is a concern that these sample containers have potentially been exposed to contamination during shipment, when it is recommended that fresh containers be obtained.)

D. The trip blank should go out to the field in a cooler (with ice) that volatile field samples containers are added to as they are collected during each day's sampling activities. Handle the blank in the same manner as the filled sample vials.

E. Assign the trip blank a sample number identifying its source, consistent with the format used for the sampling event. One suggestion is to include the sample date in the sample number to aid in matching it with the associated field samples in presentation of results in the project report (i.e. TB0401 or TRIP0401 for the trip blank associated with samples collected on 04/01).

F. Assign a date and time to the trip blank on the COC and sample container as if it were a field sample. The time stamp for the trip blank is when the first sample is added to the cooler containing the trip blank. Do not leave this field blank as the laboratory will require a date and time stamp to monitor analysis holding times. Laboratory protocols for assigning this date if left blank can vary considerably.

G. Return the trip blanks to the laboratory with the samples. Include the trip blank information along with the samples on the Chain-of-Custody form (SOP 06-02-02). Analysis is performed for the same suite of volatile organic compounds as the associated samples. (i.e., it is only necessary to request BTEX if associated samples are only analyzed for BTEX). However, if samples with different subsets of volatile constituents are collected and shipped together, select the method that covers all of the constituents. It is not necessary to analyze for both BTEX and TCL VOCs, for example.

IV. PRECAUTIONS AND COMMON PROBLEMS

A. Trip blanks should never be opened in the field.

B. If there are multiple sample teams on the project that are collecting samples separately from each other during the day, a separate trip blank should be assigned to each group which is then shipped separately to the lab.

C. Do not combine groupings of samples with different associated trip blanks into the same cooler for shipping.

D. Do not combine multiple days' worth of VOC samples into a cooler for shipment unless they have been in the same cooler with the trip blank and each other throughout the sampling process.

V. DOCUMENTATION

Describe handling of the trip blanks in the Trip Report (SOP 06-02-05). Include the sample numbers assigned and associated samples (if more than one trip blank is used).

VI. REFERENCES:

EPA, 1986. Test Methods for Evaluating Solid Waste: SW-846; Volume II. Washington, DC

EPA Region III Quality Control Fact Sheet, Field Blanks,
http://www.epa.gov/region3/esc/qa/pdf/blanks.pdf

06-01-01 MAINTAINING SAMPLE CHAIN OF CUSTODY

I. SCOPE AND APPLICABILITY

This procedure is to be employed whenever samples are collected for laboratory analysis, and is designed to ensure that sample integrity is maintained. These procedures are necessary to assure that samples are defensible, especially in situations where litigation is possible.

II. PROJECT-SPECIFIC REQUIREMENTS: None.

III. METHODOLOGY

A. **SAMPLE CUSTODY:** The sampling personnel must maintain custody of the samples until they are delivered to the laboratory, or shipping representative, after which the laboratory takes over the custody record. A sample is considered to be in custody if:

- It is in the investigator's actual possession
- It is view of the investigator
- It has been placed in a secure area
- A signed custody seal has been placed on the sample container such that the seal would be destroyed if the container was opened.

B. **CUSTODY RECORD**

1. Complete a Chain-of-Custody Form (COC) for each shipping container of samples as described in SOP 06-02-02. If samples are hand delivered to the laboratory, they must sign for receipt of the samples before the yellow/pink copies of the COC are separated from the white copy (if using three-part forms). If using an electronic version of a COC provided by the laboratory there will be only one copy, therefore it is necessary to either fax, photocopy or photograph the COC before it is sealed into the sample cooler. If samples are delivered to the laboratory via a common carrier, it is not expected that the carrier representative will sign the COC. Document the shipping tracking number on the COC. Place the appropriate copies of the completed form in a zip-lock bag taped to the inside cover of the shipping container with the samples, as discussed in SOP 06-01-03.

2. If required, affix a signed custody seal to secure all samples. Seals may be placed across the lids of individual sample bottles, or on each shipping container of samples. If seals are placed on shipping containers, at least two seals must be used, and they must be placed such that the container cannot be opened without breaking the seals.

IV. PRECAUTIONS AND COMMON PROBLEMS

It may be necessary to cover custody seals (when used) with clear postal tape to prevent them from falling off.

V. DOCUMENTATION

A. Deliver, fax a copy or text a photo of the COC to the Project Manager within 24 hours of shipping the samples so that any errors can be corrected before the laboratory begins processing the samples. If using three-part COC forms, the yellow and/or pink copies should be submitted to the Project Manager upon return to the office.

B. The Project Manager or a designee must review the form for completeness and correctness. Any errors should be flagged, and the laboratory should be contacted if errors could affect analysis

and/or sample identification. The reviewer should initial and date the form, then place it in the Project File.

C. Compliance or problems with custody procedures should be documented in the Trip Report (SOP 06-02-02).

VI. REFERENCES

EPA Region IV; 1991. Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual. Athens, Georgia.

06-01-02 SAMPLE CONTAINERS AND HOLDING TIMES

I. SCOPE AND APPLICABILITY

This SOP identifies the sample containers and laboratory holding times for environmental samples for liquids/flowables and solid matrices.

II. PROJECT-SPECIFIC REQUIREMENTS: None.

III. METHODOLOGY

Bottles and holding times are summarized in Exhibit 06-01-02. Holding times begin at the time of sampling. Preservatives should be added at the time of collection (unless samples for dissolved metals are to be filtered at the laboratory). Samples which must be kept cool must be placed in coolers with ice immediately after collection. Dissolved metal samples must be filtered prior to preservation.

IV. PRECAUTIONS AND COMMON PROBLEMS

A. Samples with short holding times must be shipped on the day of collection. Verify with the laboratory that they can process short ($\leq$ 48 hour) hold time samples that are shipped out for Saturday delivery. Plan sampling schedules accordingly.

B. Place samples on ice immediately after collection. Do not let the samples sit until the end of the day, especially in hot weather.

V. DOCUMENTATION: None.

VI. REFERENCES

40 CFR 136.3, Table II, Required Containers, Preservation Techniques, and Holding Times
EPA Office of Solid Waste and Emergency Response; 1986. Test Methods for Evaluating Solid Waste: SW-846, 3rd ed. Washington, DC.

SAMPLE CONTAINERS, HOLDING TIMES, AND PRESERVATIVES

ANALYTE	CONTAINER TYPE	PRESERVATIVE	HOLDING TIME	REQUIRED SAMPLE VOLUME [1]
AQUEOUS SAMPLES				
METALS				
Chromium VI	P, G	Cool to 4°C	24 hours	250 ml
Mercury	P, G	Nitric acid to pH <2	28 days	250 ml
Lead, Organic	G, with septa or Teflon-lined cap	Cool to 4°C	Analyze immediately	1 L
Metals, except above	P, G	Nitric acid to pH <2	6 months	1 L
ORGANIC ANALYSES				
VOCs Total Petroleum Hydrocarbons TPH/GRO/BTEX/MTBE	G w/ Teflon-lined cap	Cool to 4°C Hydrochloric acid to pH <2 0.008% Sodium thiosulfate[2]	14 days	3 x 40 ml
SVOCs Alcohols, Glycols, Phenols and any subset of SVOCs Total Petroleum Hydrocarbons TPH/DRO/ORO	G w/ Teflon-lined cap	Cool to 4°C 0.008% Sodium thiosulfate[2]	7 days until extraction, 40 days after extraction	1 L
Dioxins/Furans	G w/ Teflon-lined cap	Cool to 4°C 0.008% Sodium thiosulfate[2]	7 days until extraction, 40 days after extraction	1 L
Polynuclear Aromatic Hydrocarbo (PAHs of PNAs)	G w/ Teflon-lined cap	Cool to 4°C 0.008% Sodium thiosulfate[2]	7 days until extraction, 40 days after extraction	1 L
PCBs	G w/ Teflon-lined cap	Cool to 4°C	7 days until extraction, 40 days after extraction	1 L
Pesticides	G w/ Teflon-lined cap	Cool to 4°C	7 days until extraction, 40 days after extraction	1 L
GENERAL WATER-QUALITY PARAMETERS				
Acidity	P, G	Cool to 4°C	14 days	250 ml
Alkalinity	P, G	Cool to 4°C	14 days	250 ml
Biochemical Oxygen Demand	P, G	Cool to 4°C	48 hours	1 L
BOD, Carbonaceous	P, G	Cool to 4°C	48 hours	1 L
Bromide	P, G	None Required	28 days	250 ml
Carbon, Total Organic	G	Cool to 4°C Sulfuric acid to pH <2	28 days	2 x 40 ml
Chemical Oxygen Demand	P, G	Cool to 4°C Sulfuric acid to pH <2	28 days	250 ml
Chloride	P, G	None Required	28 days	250 ml
Chlorine, Residual	P, G	None Required	Analyze Immediately	100 ml
Coliform, Fecal and Total	P, G	Cool to 4°C 0.008% Sodium thiosulfate[2]	6 hours	250 ml
Color	P, G	Cool to 4°C	48 hours	500 ml
Conductivity	P, G	Cool to 4°C	28 days	250 ml
Cyanide, Total and Ammenable	P, G	Cool to 4°C Sodium hydroxide to pH >12 0.6g ascorbic acid5	14 days	1 L
Cyanide, Weak-Acid Dissociable	P	Cool to 4°C, NaOH to pH>12	14 days	250 ml
Cyanide, Free (Microdiffusion)	P	Cool to 4°C	48 hours	250 ml
Fluoride	P	None required	28 days	250 ml
Halogens, Total Organic	P, G	Cool to 4°C Sulfuric acid to pH <2	28 days	250 ml
Hardness	P, G	Nitric acid to pH <2	6 months	250 ml

SAMPLE CONTAINERS, HOLDING TIMES, AND PRESERVATIVES

ANALYTE	CONTAINER TYPE	PRESERVATIVE	HOLDING TIME	REQUIRED SAMPLE VOLUME [1]
Nitrate+Nitrite Nitrogen	P, G	Cool to 4°C Sulfuric acid to pH <2	28 days	250 ml
Nitrate Nitrogen	P, G	Cool to 4°C	48 hours	250 ml
Nitrite	P, G	Cool to 4°C	48 hours	250 ml
Nitrogen, Ammonia	P, G	Cool to 4°C Sulfuric acid to pH <2	28 days	500 ml
Nitrogen, Total Kjeldahl (TKN)	P, G	Cool to 4°C Sulfuric acid to pH <2	28 days	1 L
Nitrogen, Organic	P, G	Cool to 4°C Sulfuric acid to pH <2	28 days	1 L
Oil and Grease	G	Cool to 4°C, HCl or sulfuric acid to pH <2	28 days	1 L
Oxygen, Dissolved Winkler	G, bottle and top, no headspace	Fix on site and store in dark Cool to 4°C	8 hours	500 ml
Probe		None required	Analyze Immediately	
Petroleum Hydrocarbons by IR (Total Recoverable)	G	Cool to 4°C Hydrochloric acid to pH <2	28 days	1 L
pH (Hydrogen ion)	P, G	None required	Analyze immediately	100 ml
Phenolics, Total	G	Cool to 4°C Sulfuric acid to pH <2	28 days	1 L
Phosphorus, Elemental	G	Cool to 4°C	48 hours	250 ml
Phosphorus, Orthophosphate	P, G	Filter immediately, Cool to 4°C	48 hours	1 L
Phosphorus, Total	P, G	Cool to 4°C Sulfuric acid to pH <2	28 days	250 ml
Radiological Parameters (Alpha, Beta Gamma)	P, G	Nitric acid to pH <2	6 months	1 Gal
Silica	P	Cool to 4°C	28 days	250 ml
Solids, Filterable (TDS)	P, G	Cool to 4°C	7 days	250 ml
Solids, Non-Filterable (TSS)	P, G	Cool to 4°C	7 days	250 ml
Solids, Total	P, G	Cool to 4°C	7 days	250 ml
Solids, Volatile (TVS)	P, G	Cool to 4°C	7 days	250 ml
Solids, Settleable	P, G	Cool to 4°C	48 hours	1 L
Sulfate	P, G	Cool to 4°C	28 days	250 ml
Sulfide	P, G	Cool to 4°C, add zinc acetate and sodium hydroxide pH >9	7 days	250 ml
Sulfite	P, G	Cool to 4°C	24 hours	250 ml
Surfactants (MBAS)	P, G	Cool to 4°C	48 hours	1 L
Temperature	P, G	None Required	Analyze Immediately	100 ml
Turbidity	P, G	Cool to 4°C	48 hours	500 ml
SOLID SAMPLES				
METALS				
Mercury	G	Cool to 4°C	28 days	4 oz
Lead, Organic	G	Cool to 4°C	14 days	4 oz
Other Metals	P, G	Cool to 4°C	6 months	8 oz
ORGANIC ANALYSES				
VOCs - via Encore (also BTEX, TPH-GRO, MTBE)	Encore Samplers	Cool to 4°C	48 hours until extraction or freezing, 14 days after extraction	3 Encore Samplers
VOCs - via TerraCore (also BTEX, TPH-GRO, MTBE) via TerraCore	G w/ Teflon-lined septum	Cool to 4°C, sodium bisulfate in two vials and methanol in one vial.	14 days	3 x 40 ml
VOCs in carbanaceous solids via TerraCore	G w/ Teflon-lined septum	Cool to 4°C, DI water in vials, freeze within 48 hours	48 hours until extraction or freezing, 14 days after extraction	3 x 40 ml

SAMPLE CONTAINERS, HOLDING TIMES, AND PRESERVATIVES

ANALYTE	CONTAINER TYPE	PRESERVATIVE	HOLDING TIME	REQUIRED SAMPLE VOLUME [1]
SVOCs Alcohols, Glycols, Phenols and any subset of SVOCs Total Petroleum Hydrocarbons TPH/DRO/ORO	G	Cool to 4°C	7 days until extraction, 40 days after extraction	4 oz
Polynuclear Aromatic Hydrocarbo (PAHs of PNAs)	G	Cool to 4°C	14 days until extraction, 40 days after extraction	4 oz
Pesticides and PCBs	G	Cool to 4°C	14 days until extraction, 40 days after extraction	4 oz
GENERAL CHEMISTRY				
Cyanide	G w/ Teflon lid	Cool to 4°C	14	4 oz
Sulfide, Total	G w/ Teflon-lid	Cool to 4°C	7	4 oz
Fluoride	G	Cool to 4°C	28 days	4 oz
Oil and Grease	G	Cool to 4°C	28 days	4 oz
pH	G	Cool to 4°C	Analyze immediately	4 oz
Phenolics	G	Cool to 4°C	7 days until extraction, 40 days after extraction	4 oz

1) Suggested sample bottle sizes. If sample volume is an issue check with your lab to determine whether they can work with a smaller volume. Additionally some labs now provide low volume organic analysis which requires as little as 40 ML for some semi-volatile analyses. Check with project lab to see whather they offer this.

(2) Only used in the presence of residual chlorine.

07-01-03 SAMPLE PACKING AND SHIPPING

I. SCOPE AND APPLICABILITY: This procedure is applicable to the packing and shipment of samples for laboratory chemical analysis.

II. PROJECT-SPECIFIC REQUIREMENTS

A. SPECIAL SHIPPING CONSIDERATIONS: None.

B. OTHER REQUIREMENTS: None.

III. METHODOLOGY

A. PACKING

1. Use an insulated shipping container. Cover any drains with tape.

2. Place a layer of packing material (vermiculite, bubble pack, or packing peanuts) in the bottom of the shipping container.

3. Place glass sample containers in sealed plastic bags and overwrap them with bubble pack.

4. Place the samples in the shipping container.

5. If samples are to be kept cool, add several sealed plastic bags full of ice or freezer packs.

6. Fill the remaining space with packing material.

7. Place the white copy of the Chain-of-Custody Form (SOP 07-01-01) in a sealed plastic bag and tape it to the inside of the container lid.

8. Secure the container lid with postal tape and Custody Seals (SOP 07-01-01).

B. SHIPPING

Unless otherwise indicated under Project-Specific Requirements, samples must be hand delivered or shipped via overnight carrier. Samples for analysis of volatile organic compounds, BOD, hexavalent chromium, nitrate, nitrite, MBAS, bacteria, or other parameters with short holding times must be shipped on the day of collection.

IV. PRECAUTIONS AND COMMON PROBLEMS: Final times for shipper pickups vary between locations, and may be relatively early in remote locations. Check on pickup times before beginning sampling.

V. DOCUMENTATION: Retain the customer copy of the shipping bill until it is certain that the samples have been received by the laboratory.

VI. REFERENCES

Code of Federal Regulations: Title 49, Subtitle B, Parts 100-177.

06-02-02 CHAIN-OF-CUSTODY FORM

I. SCOPE AND APPLICABILITY

A Chain-of-Custody (COC) Form must be completed for each shipment of samples for laboratory analysis. The COC form is the communication record between the project field team and the laboratory login personnel. Accurate and legible completion of the COC form is necessary to insure that samples are analyzed for the correct parameters.

II. PROJECT-SPECIFIC REQUIREMENTS: None.

III. METHODOLOGY

Complete a Chain-of-Custody Form as provided by the laboratory for each shipping container of samples containing the following information (each laboratory will have their own preferred COC form so the location of the information on the form may vary):

- CEC project number and name
- Project Manager or designated CEC contact with their phone number and email
- Date and time of sample collection
- Sample number
- Sample Matrix
- Total number of bottles or jars
- Preservation (this is especially important if the laboratory is expected to preserve the bottles upon receipt)
- Suites of analyses requested, in specific terms. Examples:
  TCL VOCs
  RCRA Metals
  BTEX
  PNAs-SW846 8270/SIM
  Avoid vague descriptors like "VOCs" or "metals." If a project specific analyte list (subset of metals or organic compounds for example) has been set up with the project and is referenced on the COC, include a copy of it with each shipment to the laboratory to ensure that it becomes part of the data report and the sample custody records. It should be possible to determine exactly what sample analyses were requested/required from the COC.
- Requested turnaround time (be specific (i.e. 48 hours, 3 days, etc.,) if not standard)
- Any special notes/requests, for example indicate high PID readings if applicable, request for lower reporting limits – don't assume you will get drinking water limits just because you submit a drinking water sample, this must be requested either in advance or on the COC
- Signature of CEC person relinquishing custody to the laboratory or shipping courier
- Date and time samples were handed over to someone else or placed under custody seals

Signatures of every person who has control of the samples should appear on the Chain-of-Custody Form. If another person, even another CEC employee, takes responsibility for packing or shipping the samples after you have completed the form and before the samples have been sealed, that person should sign as receiving and subsequently relinquishing the samples.

IV. PRECAUTIONS AND COMMON PROBLEMS

- Use of vague terms such as VOCs or Metals may lead to missing parameters. Verify with the laboratory which compounds/metals are part of their standard analyses to ensure that all necessary parameters will be reported.
- Illegible sample names/IDs will lead to the sample login personnel guessing/interpreting what was written which may result in the laboratory report not reflecting the intended sample names/ID. It is often not possible for the laboratory to retroactively edit the report and more importantly the

underlying analysis records to correct sample names/IDs.

- If lower reporting limits are required, this must be communicated to the laboratory on the COC in addition to any prior communication as this may impact how samples are logged in for analysis.

V. DOCUMENTATION

Use the laboratory supplied COC forms (paper or electronic) or equivalent. If three part forms are not used, either make a photocopy, take a photo of or fax the COC before placing it in the cooler. Use of the Chain-of-Custody Form is discussed in SOP 06-01-01 and SOP 06-01-03.

VI. REFERENCES: None.

Exhibit 07-02-02

Civil & Environmental Consultants, Inc.

333 Baldwin Road
Pittsburgh, Pennsylvania 15205
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Fax (412) 429-2114

3600 Park 42 Drive
Suite 130 B
Cincinnati, Ohio 45241
Phone(513) 985-0226
Fax (513) 985-0228

400 Lazelle Road, Suite 1
Polaris Commerce Park
Columbus, Ohio 43240
Phone (614) 540-6633
Fax (614) 540-6638

Park Fletcher Business Park
2415 Directors Row, Suite E
Indianapolis, Indiana 46241
Phone (317) 484-4280
Fax (317) 484-4284

624 Grassmere Park Drive, Suite 21
Nashville, Tennessee 37211
Phone (615) 333-7797
Fax (615) 333-7751

Project No. a	Project Name b	Matrix: AQUEOUS	Matrix: NONAQUEOUS	No. of Containers	Analyses Requested e	Page	of
Samplers (signatures) c						Turnaround	
CEC Project Manager d						___ Standard f ___ Rush	
Date g	Time h	Sample ID i		j	k	l	Remarks m

Relinquished by n	Date o	Time p	Received by	Relinquished by	Date	Time	Received by
Relinquished by	Date	Time	Received by	Received by Laboratory	Date	Time	

Custody Intact Yes No	Custody Seal No.	Lab Log No.	Remarks

07-02-04 TRIP REPORT

I. SCOPE AND APPLICABILITY: The Trip Report is the primary documentation of any field activity. Trip Reports should be prepared for all sampling, drilling, and data collection activities.

II. PROJECT-SPECIFIC REQUIREMENTS: None.

III. METHODOLOGY: The Trip Report is prepared as a memorandum from the field crew to the project manager, and should include complete information concerning field activities. At a minimum, the Trip Report should include:

a. Activities performed
b. Sampling methods
c. Weather conditions
d. Field measurements and observations
e. Deviations from plans
f. Waste disposal and water handling
g. Decontamination procedures.

Additional requirements are indicated in SOPs for specific activities. Boring logs, Groundwater Monitoring Data Sheets, and photographs should be attached to the Trip Report.

IV. PRECAUTIONS AND COMMON PROBLEMS: None.

V. DOCUMENTATION: The Trip Report should be distributed to the Project Manager and Project File, as well as other individuals as necessary. The original should be placed in the Originals File.

VI. REFERENCES: None.